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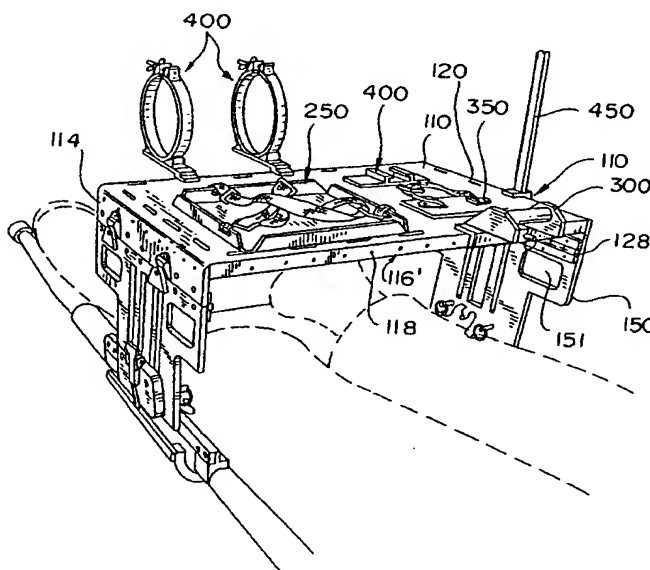
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(54) Title: CRITICAL CARE PLATFORM FOR LITTERS



(57) Abstract: This invention preferably includes a platform (100) having a support surface (110), a pair of legs (150, 150) connected to the support surface (110), and footings (152) and securing mechanism (160 or 180) on the legs (150, 150) for attaching the invention to a litter that preferably satisfies NATO requirements. Preferably, the invention attaches to the poles used to carry a patient on a litter such that the invention provides space for the patient's legs to pass under if necessary. A further embodiment of the invention adds at least one accessory clip, which preferably includes at least one attachment for a piece of medical equipment such as medical monitors, ventilators, and infusion pumps.

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CRITICAL CARE PLATFORM FOR LITTERS

I. Field of the Invention

This invention relates to a structure for attaching to litters, preferably litters that meet NATO standards, and for holding medical equipment useful in the care and/or transport of patients between locations.

II. Background of the Invention

The standard litter in use is the NATO litter or a modified version of the NATO litter. A common feature between the NATO litter and most modified versions is a two pole structure running in parallel to each other the length of an area to carry and support a patient such as nylon as illustrated in Figures 1 and 2. Usually, these litters are used in evacuating injured and/or wounded patients from their location of injury (or far forward facility) to a care facility for treatment.

During transport, it is vital to monitor a patient's current medical status to allow medical personnel to attempt to maintain the status quo, which preferable is sufficiently stable to allow for transport. Unfortunately, litters do not allow for the attachment of medical monitoring equipment given their structure of two poles and a place for the patient, which usually is canvas or a similar material. Instead of two individuals moving a patient, it may take at least one additional person to move along side the litter to move the equipment connected to the patient. Or the extra person may not be needed, because the equipment is put on top of the patient, which is not advisable in most medical situations given the weight of the equipment and notwithstanding the weight, the equipment may shift around on the patient and/or fall off of the patient and the litter. None of these possibilities associated with using the patient as the carrying platform are beneficial to treating the patient.

In the past few years, new devices and ways have been developed to transport the recently injured/wounded. Two examples are LSTAT, which is described in U.S. Patent No. 5,626,151, and MIRF, which is described in U.S. Patent No. 5,918,331. A drawback to both of these is that they have additional equipment and monitors that may not be necessary in each and every situation. The extra equipment adds weight and takes up space, in particular vertical space. In evacuation situations of multiple patients, the extra space will likely limit the number of patients that may be evacuated in any given transport vehicle due to the fact that the litter attachments will take up additional space unnecessarily.

Notwithstanding the usefulness of the above-described approaches, a need still exists for a lightweight attachment for litters that will allow particular equipment to be transported with the patient without requiring another individual to carry the equipment beyond the two individuals carrying the litter.

III. Summary of the Invention

This invention preferably is a platform for use with a litter (or stretcher); more particularly, the invention is a critical care platform for use with a standard NATO litter, chemical warfare litter, or a collapsible litter.

The invention offers the maximum flexibility in securing medical equipment and/or device(s) needed for patient care directly on the patient's litter. Human performance is enhanced by strategic placement of medical equipment and/or device(s) allowing continuous patient monitoring, improved patient care access and patient comfort. The invention is an important advancement in aeromedical equipment securing technology.

According to one form of the present invention, an apparatus for attaching to a patient carrying device and for providing an apparatus to have medical equipment in close proximity including during movement of the patient, said apparatus comprising a platform having a support surface, said support surface having a plurality of openings passing therethrough, and

at least two legs, each of said legs is connected to said support surface; at least one accessory clip in communication with said support surface, said at least one accessory clip having an interface for connection with said support surface; and at least one pin for engaging said interface of said at least one accessory clip.

According to one form of the present invention, a system for attaching to a litter and carrying medical equipment needed for the care of a patient, said system comprising a platform including a support surface having a plurality of openings passing therethrough and at least two walls depending from an opposing ends to each other, a hinge attached to each wall, and a leg attached to each hinge, said leg including two footings spaced from each other; at least one accessory table including an interface sized to communicate with at least one opening through said support surface, said interface having an opening passing therethrough, and means for attaching to at least one piece of medical equipment; and at least one pin, said pin sized to communicate with the opening of said interface and said support surface; and wherein said interface is held in communication with said support surface by said at least one pin.

According to one form of the present invention, a system for carrying medical equipment on a patient carrying device without interfering with the space for the patient, said system comprising at least one means for attaching to at least one piece of medical equipment, means for supporting and positioning said attaching means to the side and/or above the patient on the patient carrying device, said supporting and positioning means including means for adjusting the height of the supporting and positioning means relative to the litter.

According to one form of the present invention,

An objective of the invention is to provide a platform mountable upon a NATO litter that allows attachment of a variety of medical equipment.

Another objective of the invention is to provide a place to mount life packs, infusion pumps, a ventilator, and/or a suction unit onto a litter.

Another objective of the invention is to provide an attachment to a litter for the placement of medical monitoring equipment and life support equipment.

Another objective of the invention is to provide a litter attachment that is reducible for storage.

Another objective of the invention is to allow for the rotation of monitoring equipment positioned upon the invention.

Another objective of the invention is to provide flexibility in the type of equipment that may be attached to the invention and where on the invention the equipment is placed. A further objective is that a change in the standard medical equipment and/or device(s) will not require that the entire invention be redesigned but instead that a new accessory clip be designed to accommodate the new piece of medical equipment and/or device(s).

Another objective of the invention is to provide a removable accessory table.

A further objective of the invention is to provide multiple positions for a pump while it is attached to the invention.

A further objective of the invention is that it is modularized for various equipment such as monitors, ventilators, intravenous pumps, oxygen bottles, or large life pack monitors.

A further objective of the invention is the ability to withstand vehicular (including aircraft) vibrations while remaining attached to a litter and maintaining the attachment of medical equipment and/or device(s). At least one embodiment of the invention preferably is designed to withstand at least 8 Gs.

A yet further objective of the invention is to provide a low profile when equipment is attached as compared to a patient laying on a litter without the invention being attached.

A yet further objective of the invention is that when mounted on a litter, the litter may still be stacked within a vehicle.

A yet further objective of the invention is to have a lightweight platform.

A still further objective of the invention is the quickness at which it may be attached to or removed from a litter.

A still further objective of the invention is that it be non-corrosive and not susceptible to rust.

An advantage of the invention is the firmness of the attachment between it and a litter.

Another advantage of the invention is the stability achieved for the medical equipment and/or device(s) present on it.

Another advantage of the invention is the flexibility offered in the medical equipment and/or device(s) that may be attached to it.

Another advantage of the invention is that when tilted the attached medical equipment and/or device(s) will not fall off.

Another advantage of the invention is that there are at least two different mounting positions for an infusion pump each of which offer different visual angles.

Another advantage of the invention is that a medical monitor may be rotated between multiple positions to improve viewing by the medical personnel providing care for and/or transporting the patient.

A further advantage of the invention is that when mounted on a litter it will not interfere with the placement of the litter on litter stands or carts.

A further advantage of the invention is that it accomplishes the above-identified objectives.

A yet further advantage of the invention is that it provides for flexibility in the medical equipment and/or device(s) that may be attached offering modularity in the types of attachment.

A yet further advantage of the invention is that at least one embodiment is approved for use during all phases of flight on all U.S. Air Force aircraft (including fixed and rotary wing).

A still further advantage of the invention is that in at least one embodiment allows for height adjustment relative to the litter.

Given the following enabling description of the drawings, the invention should become evident to a person of ordinary skill in the art.

IV. Brief Description of the Drawings

The present invention is described with reference to the accompanying drawings. In the drawings, like reference numbers indicate identical or functionally similar elements. The use of cross-hatching and shading within the drawings is not intended as limiting the type of materials that may be used to manufacture the invention.

Figure 1 illustrates an embodiment according to the invention attached to a litter with medical equipment attached to the invention.

Figure 2 depicts another embodiment according to the invention attached to the litter with medical equipment attached to the invention.

Figure 3 illustrates the embodiment shown in Figure 1 unattached to a litter.

Figure 4 depicts the embodiment shown in Figure 2 with a variety of accessory clips attached to the platform according to the invention.

Figure 5 illustrates a top view of a platform according to the invention.

Figure 6(a)-(d) depict a variety of views of an exemplary monitor accessory clip according to the invention. Figure 6(a) illustrates a perspective top view of the accessory clip. Figure 6(b) depicts a bottom view of the entire accessory clip. Figure 6(c) illustrates a bottom view of the monitor platform portion of the accessory clip. Figure 6(d) depicts a cross-section of the center portion of the accessory clip.

Figures 7(a)-(c) depict an exemplary infusion pump accessory clip according to the invention. Figure 7(a) provides a perspective view from the bottom. Figure 7(b) is a side view. Figure 7(c) is a top view. Figure 7(d) depicts an alternative embodiment for a portion of the accessory clip shown in Figures 7(a)-(c).

Figures 8(a)-(b) illustrate an exemplary ventilator accessory clip according to the invention. Figure 8(a) depicts a top perspective view. Figure 8(b) illustrates a bottom view of the accessory clip.

Figures 9(a)-(b) depict another exemplary ventilator accessory clip according to the invention. Figure 9(a) is a side view. Figure 9(b) is a top view.

Figures 10(a)-(b) illustrate an exemplary IV bag accessory clip according to the invention. Both figures offer different side views.

Figure 11 depicts an exemplary cylinder object accessory clip according to the invention.

Figures 12(a)-(b) illustrate an exemplary multiple attachment accessory clip according to the invention. Figure 12(a) illustrates the accessory clip attached to a platform according to the invention. Figure 12(b) illustrates a side view of the accessory clip by itself.

Figure 13 depicts another exemplary multiple attachment accessory clip according to the invention attached to a litter.

Figure 14 illustrates a side view of an alternative cylinder object accessory clip according to the invention.

Figure 15 depicts a bottom perspective view of an embodiment according to the invention.

Figures 16(a)-(c) illustrate different views of the connector according to the invention.

Figures 17(a)-(b) depict another accessory clip according to the invention.

Figures 18(a)-(b) illustrate a view of the leg portion of an embodiment according to the invention. Figure 18(a) illustrates the leg without a securing mechanism according to the invention.

Figure 19 depicts a locking mechanism according to the invention.

Figures 20(a)-(b) illustrate a brace according to the invention. The break lines indicate the incomplete nature of the platform illustrated in these Figures.

Figures 21(a)-(b) depict a sleeve according to the invention. The break lines indicate the incomplete nature of the platform illustrated in these Figures.

Figures 22(a)-(c) illustrate a height adjustment alternative embodiment according to the invention.

Figures 23(a)-(b) depict another height adjustment alternative embodiment according to the invention.

Figures 24(a)-(b) depict a cylinder attachment to a litter according to the invention.

V. Detailed Description of the Drawings

The invention preferably is for holding medical equipment and/or device(s) that is required for assisting in the care of a patient on a litter. The patient may be human or animal that is able to be carried upon a litter such as a litter conforming to NATO standards, chemical warfare litter, a collapsible litter or other patient carrying mechanism. More particularly, the

invention preferably includes a platform and at least one accessory clip. As illustrated, for example, in Figures 1 and 2, the platform 100 preferably attaches to the litter or other patient carrying mechanism, while also preferably being able to stand on its own when not attached to a litter or other patient carrying mechanism. The platform 100 and its different embodiments are a means for supporting and positioning said attaching means to the side and/or above the patient on the patient carrying device. Preferably, the at least one accessory clip (or apparatus clip) allows for at least one piece of medical equipment, device(s), and/or container(s) such as monitors (250), pumps (300), ventilators (350, 400), suction units, IV bags (450), oxygen bottles (500) to be attached to the platform as illustrated, for example, in Figure 2.

The platform 100 preferably includes a support surface 110 and at least two legs 150, 150. More preferably, there are two legs with one leg 150 at each end of the support surface 110 as illustrated, for example, in Figures 1-4. Although the legs 150, 150 are shown at the ends of the support surface 110, the legs 150, 150 may be spaced independently or separately from the ends of the support surface 110. The support surface 110 preferably extends across the width of the litter and its length across the litter is preferably greater than its depth along the length of the litter as illustrated, for example, in Figures 1 and 2. The support surface 110 preferably includes multiple connection points along at least one of the top 112 or sides 114, 116 for connecting the accessory clip(s) to the support surface 110 as illustrated, for example, in Figures 4 and 5.

The accessory clip preferably attaches to the platform 100 such that it will not become unintentionally separated from the platform 100. The accessory clip preferably includes an attachment for medical equipment, device(s), and/or container(s) as illustrated, for example, in Figures 6(a)-15. The accessory clip also preferably includes an interface for attaching to the platform, and more preferably for engaging at least one of the multiple connection points of the support surface.

Preferably, the connection between the accessory clip and the platform is solidified by at least one accessory pin 190 as illustrated, for example, in Figures 1, 12(a), and 15. The accessory pin 190 may for example be a quick-release pin such as a positive-locking pin or a hand-retractable spring plunger. More particularly, the accessory pin 190 could be a ring-grip style, recessed-button style, T-handle style, L-handle style, or button-handle style. Each accessory pin 190 preferably includes a bearing at an insertion end 192 to hold the accessory pin 190 in place once inserted through a hole in the interface. Each accessory pin 190 preferably also includes a pull mechanism 194 such as a ring at the other end of the accessory pin 190. Preferably, the accessory pins 190 will release upon the application of a pulling force along the radial center or parallel to the radial center of the accessory pin 190. Preferably, the interface and the accessory pins 190 work in conjunction with each other to connect the accessory clip to the support surface 110 of the platform 100.

More particularly as illustrated, for example, in Figures 3, 4, and 15, the support surface 110 of the platform 100 preferably is attached to each of the legs 150 with a respective continuous hinge 128 preferably using, for example, screws, rivets, harden cores such as made from steel, bolts, welding, adhesives, bonding or other similar type connection devices. However, other equivalent devices could be used to attach the legs 150, 150 to the support surface 110. These various attachment methods may be used when connection or attachment between two pieces/elements is needed in connection with this invention. The support surface 110 preferably includes a top 112 and a vertical wall 114 extending down from the top on at least the two ends where the legs 150 are attached. More preferably, the support surface 110 also has a vertical wall 116 depending from the other two sides such that vertical walls 114, 116 frame the underside of the support surface 110. More preferably, the vertical walls 114, 116 include a series of holes 118 for engaging accessory pins 190 as illustrated, for example, in Figure 4. Walls 114, 116 although shown as being on the edge of the support surface 110, the walls 114, 116 may be spaced independently or separately from the edges of the support surface 110. Preferably, the top surface 112 of the support surface 110 includes multiple slots and/or holes 120, 121 as illustrated, for example, in Figure 4. More preferably, for at least some of the holes 118 in a vertical wall 114, 116 there is a corresponding slot 120 parallel to the side wall 114, 116. Also more preferably, for each of the remaining slots 121 through the support surface 110 there is a respective tab 122 on the bottom of the support surface 110 with a hole 124 passing through it and a paired slot as illustrated, for example, in Figure 5. Alternatively, there may be a rectangular hole(s) 121a and/or circular hole(s) 121b that corresponding to the pairs of slots 121, 121 for particular accessory clips. Alternatively, the vertical walls 116 running the length of the platform 100 may be attached bars such as a reinforcing bar 116' as illustrated, for example, in Figure 4 instead of being unitarily formed with the support surface 110.

The accessory clips preferably include one of two interfaces. The first interface preferably is a pair of tabs 200 each of which has a hole 202 passing therethrough as illustrated, for example, in Figure 9(a). The tabs 200 preferably are inserted through the slots 121 along the top of the support surface 110. In most embodiments using the pair of tabs 200, the tabs 200 will depend from a base or bridge 204. The second interface preferably is a connector 205 that includes a tab 210, a bridge 214, and a tongue 216 as illustrated, for example, in Figures 16(a)-(c). The tab 210 preferably is vertical and connected to the bridge 214, which preferably is horizontal. The tab 210 preferably includes a hole 212 passing therethrough. The tongue 216 preferably extends from the bottom of the other end (opposite the tab 210) of the bridge 214 such that it can be inserted into a slot 120 along the top of the support surface 110 while aligning the hole 212 in the tab 210 with a hole 118 on the side wall 114, 116 of the support surface 110. The aligned holes 118, 212 preferably allow an accessory pin 190 to be inserted through both holes 118, 212. More preferably, the bottom end of the tongue 216 nearest the bridge 214 is chamfered as illustrated, for example, in Figure 16(a).

Alternatively, the top portion of the intersection of the tongue 216 and bridge 214 may also be chamfered. Alternatively, the tab 210 may connect a pair of bridges 214, 214 and tongues 216, 216 with the hole 212 passing through a central point on the tab 210' as illustrated, for example, in Figure 7(a).

Different accessory clips preferably are able to attach to medical equipment and/or device(s) such as monitors, ventilators, pumps, suction units, other lightweight equipment, or medical containers such as oxygen bottles, IV bags, and blood bags. Depending upon what is to be attached to the invention, the accessory clip will be the way to attach a particular device. As such the invention provides flexibility to allow the addition of new accessory clips to fit new medical equipment and/or device(s) that may be developed in the future or be adopted for use without requiring that the entire litter stand be redesigned, rebuilt, or retrofitted to work with the new medical equipment and/or device(s). Examples of different possibilities for the accessory clip are described below and each of the described ways to accomplish the attachment to an external object is a means for attaching to at least one piece of medical equipment, which includes medical devices and/or medical containers as those terms are commonly understood and have been explicitly defined in this specification.

Figures 6(a)-(d) illustrate one possible accessory clip 250, which provides an attachment for a medical monitor 900. This accessory clip 250 preferably allows for rotation and setting of the medical monitor 900 to different angles on the platform 100 to optimize the viewing for the medical personnel who are treating, caring for or transporting the patient. This accessory clip 250 preferably includes a monitor platform 270, a disc 252 attached to the monitor platform 270, a bearing 256, a base 260 with a two tab interface 200, 200, a second bearing 264, and a hub 266. Preferably, there is a screw or bolt 269 that connects the hub 266 to the disc 252 attached to the monitor platform 270. More preferably, there are washers 254, 258, 262, 266 on either side of both bearings 256, 264, and the washers 254, 258, 262, 262 preferably are made from nylon or Teflon. The bearings 256, 264 allow the monitor platform 270 to rotate relative to the base 260 and thus the platform 100. The hub 268 may include a partial housing 268' to provide protection for the lower bearing 264 and any accompanying washers 262, 266 as illustrated, for example, in Figures 3 and 12(b). Possible bearings include, for example, thrust bearings, steel ball thrust bearings, steel tapered-roller bearings, a rolling bearing, and a lazy susan bearing. Most preferably, the bearings are a steel needle-roller thrust bearing. Instead of bearings other possible materials capable of allowing the relative rotation may be used. Alternatively, the bearings 256, 264 respectively may be countersunk into the base 260 and/or the monitor platform 270 to reduce the height of this particular accessory clip 250. If the upper bearing 256 is countersunk into the monitor platform 270, then a low resistance (if not non-friction) coating could be applied to the cavity formed in the monitor platform to reduce friction with the possible elimination of the disc 252. Likewise, if the lower

bearing 264 is countersunk into the base 260, a low resistance (if not non-friction) coating could be applied to that cavity and the hub 268 and the bolt 269 could possibly be omitted.

Alternatively, the monitor accessory clip 250 may include a locking system 290 capable of engaging holes 292 around the periphery of both bearings 256, 264 as illustrated, for example, in Figure 6(b)-(c). The locking system 290 preferably is offset from the tabs 200, 200 of this accessory clip 250, and more preferably the locking system 290 passes through another hole 121b separate from the tabs 200, 200. More preferably, the locking system 290 is a pressure driven ball bearing system, a spring plunger, or a spring loaded ball bearing that pushes vertically into a respective hole. Most preferably, the locking system 290 will include a plunger mechanism responsive to the user applying a downward force to rotate the monitor platform between locking positions. The locking system preferably allows for locking the monitor platform at multiple fixed positions. Preferably, the positions include positions at 0°, 90°, 180°, and 270°. Alternatively, the positions may be spaced at 45° intervals or any other intervals that are desired. Another alternative is that the positions might be spaced at 15° or 30° intervals; however, in interval could be created with appropriate spacing of the holes.

Alternatively, the monitor accessory clip may include a pair of straps that fit over a monitor placed on the monitor accessory clip as illustrated, for example, in Figure 6(a). Each pair of straps includes two straps 282, 284 that have one end connected (or attached) to the edge of the monitor platform 270, which may include vertical walls 272 that frame all or a portion of the monitor platform 270. The two straps preferably include one strap 282 with a cinch ring (or an eyelet) 2822 for passing the other strap 284 of the pair through it to allow for tightening the straps together to hold the monitor 900 on the monitor platform 270. The second strap 284 preferably will include Velcro to hold the strap pair and the monitor 900 in a set position once tighten. Alternatively, the first strap and/or the second strap may include a length adjustment cinch ring (or buckle).

Another possible accessory clip 300 provides an attachment for an infusion pump 910 as illustrated, for example, in Figures 7(a)-(c). This accessory clip 300 preferably allows for the attachment of an infusion pump 910 in multiple different positions. This accessory clip 300 preferably includes at least one connector 205, a base 302, two upright members 304, 306, and a mount 308. The base 302 preferably is attached to the bridge 214 of the connector 205; alternatively the base 302 may be attached to the tab 210. If there is one connector 205, then the base 302 preferably is centered about the connector 205. If there are two connectors 205, then preferably the connectors 205 are spaced at opposite ends of the base 302, which preferably will also serve as the tab 210 or 210' for this accessory clip. Preferably, the mount 308 runs between the two upright members 304, 306, which extend up from the base 302. Alternatively, the two upright members 304, 306 may include stops 310 or 312 to assist in the angling of the infusion pump 910 relative to the platform 100 as illustrated, for example, in

Figures 7(d) and 12(a), respectively. Alternatively, the connector 205 may be replaced with a pair of tabs 200, 200.

The accessory clip 350 illustrated, for example, in Figures 8(a)-(b) provides an attachment for a ventilator 920, suction unit, other cylindrical devices, or any other equipment prone to be attached using straps 360, 362. This accessory clip 350 preferably includes a pair of tabs 200, 200, a base 352, and at least one pair of straps 360, 362. The straps 360, 362 preferably are attached to opposite sides of the base 352. The straps 360, 362 preferably are similar to the straps described in connection with the monitor accessory clip 250.

Another possible accessory clip 400 for attaching a ventilator 925, particularly a Impact Instrumentation, Inc. (West Caldwell, New Jersey, U.S.A.) Model No. 754, is illustrated in Figures 9(a)-(b). This accessory clip 400 preferably includes a pair of tabs 200, 200, a base 405, and a rail mount (or dove tail mount) 410. The rail mount 410 preferably extends up from the base 405 and includes a pair of parallel rails 412, 414. Each of the rails 412, 412 preferably includes a piece 414 that extends up and a horizontal piece 416 that extends towards the opposing rail 412 and is parallel to the base 405 as illustrated in Figure 9(a). Alternatively, a knob or other tightening mechanism 420 may pass through the base 405 such that it is able to communicate with a ventilator 915 that has been sled into the rails 412, 412 to provide a better connection between the accessory clip 400 and the ventilator 915 as illustrated in Figure 9(a). A further alternative is to replace the pair of tabs with at least one connector such that the ventilator can be mounted vertically on the platform.

Another possible accessory clip 450 is illustrated, for example, in Figures 10(a)-(b) and is for connecting an IV bag, blood bag and/or other type of fluid bag or anything else that would be benefited from being elevated above both the patient and the platform. This accessory clip 450 preferably includes a connector 205 connected to a pole 455 having at least one hook 460 at the top of the pole 455. The hook 460 preferably loops around to provide a horizontal component at its top as illustrated in Figure 10(b). Alternatively, there may be two hooks 460, 460 on opposing sides of the pole 455 as illustrated in Figure 10(b). More preferably for the alternative embodiment is that the hooks 460, 460 extend out from the pole 455 parallel to the side of the platform 100 that the pole 455 is attached to.

Another possible accessory clip 500 is for attaching an oxygen (or other gas) bottle 930 or cylindrical object to the platform 100 as illustrated, for example, in Figure 11. This accessory clip 500 preferably includes a pair of gussets. Each gusset preferably includes a connector 205 with a cantilever 510 extending out from the connector 205 with a clamp 520 extending up from the cantilever 510. More preferably, the cantilever 510 is channeled away from the clamp 520 to increase its respective strength. The clamp 520 preferably includes a pair of bases 522 with an O-ring shape clamp 524 setting on the pair of bases 522. Examples of clamps that will work for this application are ones manufactured by Clampco Products, Inc. (Wadsworth, Ohio,

U.S.A.). Alternatively, the clamp could have any cross-section to fit a variety of objects such as objects with rectangular, square or oval cross-sections.

Another accessory clip 550 is a pair of straps for holding a box (or rectangular) shaped medical equipment such as a Life Pak 940 as illustrated, for example, in Figures 17(a)-(b). Each of the pair of straps preferably includes two straps 560, 570 each with an accessory pin 190 attached with a ring 552 to the strap 560, 570 for attaching that end to one of the side holes 118 of the platform 100. The pair of straps otherwise preferably are similar to those described in connection with a few of the alternative embodiments of the monitor accessory clip 250. More particularly, the strap 560 includes a buckle 562 to adjust the strap length and a cinch ring 564, and the strap 570 preferably includes Velcro. These pair of straps may also be used to hold the legs 150 in a folded position for storage to minimize the amount of storage space needed to store the invention.

Another accessory clip 600 includes multiple attachments for different pieces of medical equipment. An example of this is illustrated, for example, in Figures 1 and 12(a)-(b), which shows an accessory clip 600 with a monitor mount 250', a ventilator strap mount 350', and an infusion pump mount 300'. This accessory clip 600 preferably includes four tabs 200 at its corners attached to the platform with accessory pins 190, more preferably two tabs at both ends that are parallel to side walls 114. The accessory clip 600 illustrated in Figure 12(a) also shows a different hole setup for the support surface 110 of the platform 100 that in the illustrated set-up allows for two positions for the illustrated accessory clip 600.

Figure 13 illustrates a modification to the above embodiment where the accessory clip 600' covers most of the top of the support surface 112. This accessory clip 600 preferably includes four tabs 200 at its corners attached to the platform with accessory pins 190, more preferably two tabs at both ends that are parallel to side walls 114. This illustrated embodiment includes the rail ventilator mount 400'. The illustrated embodiment also shows an alternative oxygen bottle mount 500' that has the cantilever 510 extending in the vertical direction. Figure 13 also illustrates this accessory clip 600' with a set of medical equipment filling the available mounts 250', 300', 400'.

Figures 13 and 14 illustrate an alternative mounting arrangement for the oxygen bottle accessory clip 500' that replaces the connector 205 with a clamping mechanism 530. The clamping mechanism 530 preferably includes a horizontal member 532 through which a tightening mechanism 534 passes through such as a screw with a flat plate or end for applying pressure on the top of the support surface 110 of the platform 100. The bottom of the clamping mechanism 530 preferably includes an L-shaped member 536 that goes under the side wall 114 or 116 of the platform 100 such that the platform side wall 114 or 116 fits between the cantilever 510 and the vertical member 5362 of the L-shaped member 536. Alternatively, the screw 534 could apply pressure from below the support surface 110. Alternatively, this clamping mechanism 530 may also be used in place of the connector 205 on other accessory clips.

As illustrated, for example, in Figures 4, 15, and 18(a)-(b), each of the legs 150 preferably includes a leg connected to the platform with a hinge 128 and a hooking mechanism 160 that is connected to the leg 150 such that it may move about the connection between the leg 150 and the hooking mechanism (or securing mechanism) 160. The leg 150 preferably includes at least one footing 152 that is capable of resting on top and/or against the pole of a litter. More preferably, there are two footings 152, 152, which if side walls 116 are present on the long sides of the support surface 110 and the footings 152, 152 are spaced apart a distance about the width of the support surface 110, then preferably there are cutouts 1522 on the footings 152, 152 such that footings 152, 152 will not interfere with the leg 150 being folded up under the support surface 110.

The hooking mechanism 160 preferably includes at least one hook 162 and a locking mechanism 170 to lock the hook 162 about the pole of the litter as illustrated, for example, in Figure 4. More preferably, the hooking mechanism 160 includes two hooks 162, 162 connected with a crossbar 164 that then connects with a pair of poles 166, 166 attached to respective locking mechanisms 170, which are preferably connected by a handle 168, as illustrated, for example, in Figure 18(b). However, in an alternative embodiment there may be just one pole 166 and one locking mechanism 170 with no handle 168.

The locking mechanism (or latching mechanism) 170 preferably is a cam lock. Each of the cam locks may be a draw latch such as a blade draw latch, lever draw latch, or a compression spring draw latch; or an adjustable draw latch such as enclosed push latches, expose pull latches or padlocking exposed pull latches. Figures 18(b) and 19 illustrate the most preferred structure for the locking mechanism 170. The locking mechanism 170 preferably includes a locking piece 172, a lever 174, and a bracket 176. The locking piece 172 flips up and engages a strike 178 (shown in Figure 3) as illustrated, for example, in Figure 19. The lever 174 then is flipped up to push locking piece 172 downward within bracket 176 to hold the locking mechanism 170 in place relative to the strike 178 as illustrated, for example, in Figure 18(b). Alternatively, the locking piece 172 and the strike 178 may be formed as a unitary piece (not shown).

Alternatively, each of the legs may include at least one stabilizing mount (or securing mechanism) 180 in place of the hooking mechanism 160 as illustrated, for example, in Figures 3 and 12(a). A similar cam locking mechanism 170 is preferably used to lock in place the stabilizing mount 180. In this alternative embodiment, the legs 150, 150 each have two pairs of mounts, or alternatively one pair of mounts may be used per side of the table. Each pair of mounts includes the footing 152 and one stabilization mount 180 that both preferably are tapered to fit the poles of a litter as illustrated, for example, in Figure 3. Each pair of mounts also preferably includes a strike 178 and a locking mechanism 170 attached to the stabilization mount 180 for engaging the strike 178. Preferably, the locking mechanism 170 slides with the stabilization mount 180 along a slot 182 for engaging litter poles or for storing of the device if at

least one catch 108 preferably is provided on the bottom of the support surface 110 for each leg 150. Alternatively, the locking mechanism 170 may be flipped with the strike such that the strike is attached to the stabilization mount and/or the support mount may slide within the slot in addition to or instead of the stabilization mount. A further alternative is that there is one footing 152 and/or stabilization mount 180 per side of the litter stand.

Another alternative embodiment is to add a mechanism to lock the leg relative to the platform. One possibility is to use a brace 800 similar to that illustrated in Figures 20(a)-(b). The brace preferably includes a Y-shaped member with the tops (or ends) 802, 802 of the Y attached and/or connected to the leg 150 preferably approximate to the hinge 128. Preferably, there is a support member 803 connecting ends 802, 802. The other end of the Y 804 preferably includes either a single end or a dual end with a hole 806 passing therethrough. The dual end preferably would fit about a tab 200 such that the holes 806 passing through the dual end would be able to be aligned with the hole 202 of the tab 200. Likewise, the single end would have a hole 806 such that it can be aligned with the hole 202 of the tab 200. An accessory pin 190 preferably is used to connect the brace 800 to the respective tab as illustrated, for example, in Figure 20(b). When the leg 150 is folded up, the brace 800 preferably rests between the leg 150 and the support surface 110.

Another possibility for locking the leg 150 relative to the support surface 110 is at least one butterfly lock (or a lift and turn draw latch) 820, which is locked in place by turning the flip up handle either clockwise or counterclockwise and the reverse to unlock. The butterfly lock 820 preferably crosses on the outside over the hinge 128 as illustrated in Figures 2 and 4.

A third possibility for locking the leg 150 in place is a sleeve 840 that covers the hinge 128 when the leg 150 is in place for use as illustrated, for example, in Figures 21(a)-(b). The sleeve 840 may replace or be in addition to the hinge 128. The sleeve 840 preferably includes an internal ridge (or rim) for engaging a corresponding ridge (or rim) 1142 around the lower end of wall 114, 114 to prevent the sleeve 840 from sliding down the leg 150. The sleeve 840 preferably slides up so that the leg 150 may be folded underneath the support surface 110.

Another alternative embodiment for the leg 150 is a height adjustment feature, which will be referred to as a means for adjusting the height of the supporting and positioning means relative to the litter. Preferably, the height adjustment feature is accomplished with each leg preferably having at least two pairs of height holes 862 along at least one slot 864. More preferably, there are three pairs of height holes and two slots as illustrated, for example, in Figures 18(b) and 22(a)-(c). The slots 864, 864 preferably allow a slide piece (or slider) 866 to slide the length of the slots 864, 864 for height adjustment of the litter stand on a litter. The slide piece 866 preferably connects the support piece 154 to the hooking mechanism 160, which preferably are on opposite sides of the leg 150. The slide piece 866 may for example be a spacer(s), a washer(s), a nut(s), a bolt(s), or some combination of these items. The slide piece 866 preferably attaches either to the handle 168 or the locking mechanism 170 of the

hooking mechanism 160. The slide piece 866 preferably attaches to the support piece 154 that includes a crossbar 156 that connects the footings 152, 152. The support piece 154 preferably includes a pair of holes that can be in communication with one set of the height adjustment holes. The footings 152, 152 and the crossbar 156 may be above the bottom of the leg 150, which will be outside of the litter poles, particularly if the leg has a T-shape as illustrated, for example, in Figure 22(a). The crossbar 156 preferably includes a pair of holes 1562 to be aligned respectively with the height holes 862 such that accessory pins 190 may secure the height. More preferably, the holes in the crossbar 156 are countersunk.

Figures 18(a)-(b) illustrate another alternative embodiment for the leg is to include a pair of cutouts 151, 151 towards the top end of the leg 150 to allow for the belt on particular vehicles such as a Blackhawk helicopter to secure the litter to prevent it from moving about the vehicle during travel. This cutout 151 comes in particular use when used in conjunction with the height adjustment feature embodiment and the leg 150 is set for its lowest position. Otherwise, the alternative embodiment of a T-shaped leg allows that same seatbelt to pass below the leg in either the preferred embodiment or in the case of the height adjustment feature alternative embodiment when the leg height is set in the bottom two pairs of holes.

Another alternative embodiment for the height adjustment feature is the inclusion of telescoping legs as illustrated in Figures 23(a)-(b). The legs 150a, 150b preferably are held together with a screw or other similar locking mechanism 1502 that passes through a respective slot 1504 in each of the legs 150a, 150b. The leg 150a may be on the outside of leg 150b as illustrated in Figure 23(a), or the legs 150a, 150b may be reversed as illustrated in Figure 23(b). Additionally, there may be multiple screw elements 1502 for each leg pair 150a, 150b.

A still further alternative embodiment is to have a variable length for the support surface to allow the platform to be fitted to different width patient carrying devices. Preferably, this would be accomplished using a slide mechanism similar to that described above in connection with slide height adjustment for the legs.

Another alternative embodiment is to add a handle 102 to an embodiment that includes at least one side wall 116 running across the litter as illustrated, for example, in Figure 3. The handle 102 preferably would be placed in the center of the length of one side wall 116 to facilitate transport of the invention when reduced for storage. A further alternative is to line that handle 102 with foam, rubber, cloth, or other soft material. Another alternative embodiment adds a handle 102' through the support surface 110 as illustrated, for example, in Figure 5.

Another alternative embodiment is to have interchangeable footings for different type of patient carrier apparatuses. Examples are a curve insert as described above for use with pole litters and a square insert for use with gunneries or other patient carrying devices that might have square pipe for the support skeleton. Other types of inserts are possible. Preferably, these inserts would be held in place by a plunger mechanism, screw mechanism, or an

accessory pin. Alternatively, the footing could be designed to have the particular insert as a unitary piece to fit certain type of patient carrying devices.

A further alternative embodiment is to remove excess material from the platform to reduce the weight of the overall platform as illustrated, for example, in Figure 1. Or alternatively, the two legs of the platform may instead be four legs with no material filling in the area between them similar to legs on a chair.

Another alternative embodiment connects paired accessory pins 190, 190 together with a lanyard (or cord, elastic material) 196 connecting the pair together, illustrated for example in Figure 11, or connecting 1962 an individual accessory pin 190 to a particular accessory clip 400, illustrated for example in Figure 9(a). The lanyard 196 prevents the accessory pin(s) 190 from being displaced from a particular accessory clip. Also, in the case of the oxygen bottle accessory clip 500 the accessory pins 190, 190 may be connected to each other and thus with a pull of the lanyard 196, the accessory pins 190, 190 come free from their respective holes and the oxygen bottle accessory clip 500 may be removed as illustrated, for example, in Figure 11.

Another alternative embodiment adds a pair of support mechanisms 700, 750 for attaching a cylinder object to the litter that are similar to the oxygen bottle accessory clip 500. Figures 24(a)-(b) illustrate this pair of support mechanisms. The support 700 preferably includes an O-ring clamp 710 mounted on a bracket piece 720 similar to the mounts present on the litter stand. At the bottom of the bracket piece 720 there preferably is a swing arm (or cantilever) 730 that engages a litter stirrup and/or the litter stand. The support 750 preferably includes an O-ring clamp 760 on a bracket piece 770 similar to the oxygen bottle accessory clip 500 present on the litter stand. At the bottom of the bracket piece 770 there preferably is a swing arm 780 that engages the litter stand and/or a second litter stirrup. Figure 24(b) illustrates the swing arm 780 positioned for attachment to a litter. Preferably, the swing arms 730 and 780 are of different lengths such that a large oxygen bottle may be attached to the litter. The bracket pieces 720 and 770 preferably are shaped to fit other a litter pole and hold the oxygen bottle snug to the litter. Figure 24(c) illustrates a modified bracket 720' that may be used instead of brackets 720 and/or 770.

VI. Industrial Applicability

[0100] This invention is useful in the transport of patients from their location where the health problem or injury occurred to a location for treatment and care. An example of this is transporting a wound individual from the battlefield to medic station on to more substantial medical facilities while allowing the needed medical equipment to be transported along with the patient without causing harm to the patient or requiring a third individual to assist in the moving of the patient. The above described embodiments provide for a wide variety of flexibility in the medical equipment that is carried along with a litter thus allowing the caregiver's to select the medical equipment that will most likely be needed while leaving behind the medical equipment not likely to be needed. Additionally, the invention provides for storage of the accessory clips in

an upside down orientation relative to the support surface by flipping the platform over, aligning the tab holes of the accessory clip with the tab holes of the support surface, and inserting the appropriate number of accessory pins.

[0101] The preferred and alternative embodiments described above may be combined in a variety of ways with each other. Furthermore, the dimensions, shapes, sizes, and number of the various pieces illustrated in the Figures may be adjusted from that shown.

[0102] Although the present invention has been described in terms of particular preferred and alternative embodiments, it is not limited to those embodiments. Alternative embodiments, examples, and modifications which would still be encompassed by the invention may be made by those skilled in the art, particularly in light of the foregoing teachings.

[0103] Those skilled in the art will appreciate that various adaptations and modifications of the preferred and alternative embodiments described above can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described herein.

IN THE CLAIMS:

We claim:

1. An apparatus for attaching to a patient carrying device and for providing an apparatus to have medical equipment in close proximity including during movement of the patient, said apparatus comprising:

a platform having

a support surface, said support surface having a plurality of openings passing therethrough, and

at least two legs, each of said legs is connected to said support surface;

at least one accessory clip in communication with said support surface, said at least one accessory clip having an interface for connection with said support surface; and

at least one pin for engaging said interface of said at least one accessory clip.

2. The apparatus according to claim 1, wherein a space is created between said support surface, said legs, and the patient carrying device such that legs of a patient may enter that space.

3. The apparatus according to any of claims 1 or 2, wherein each of said legs including a support piece having at least one opening passing therethrough and at least two footings spaced from each other,

a securing mechanism,

a pair of slide pieces each of which is connected to said support piece and said securing mechanism, and

each of said legs having at least two pairs of openings passing therethrough and two slots running parallel to each other and between the members of the opening pairs, each of said slide pieces is in communication with a respective slot, said at least one pin is sized to fit through one of the openings in said leg and the opening in said support piece, and the opening in said support piece is in communication with at least one opening passing through said leg.

4. The apparatus according to any of claims 1-3, further comprising at least two hinges, wherein each leg is attached to one of said hinges and said hinge is attached to said support surface.

5. The apparatus according to any of claims 1-4, wherein said support surface includes a top surface and a wall extending down from at least one end of said top surface.

6. The apparatus according to any of claims 1-5, wherein each of said legs includes a member,

a footing connected to said member, and

a securing mechanism in communication with said member; and

wherein said footing and said securing mechanism engage the patient carrying device.

7. The apparatus according to claim 6, wherein said securing mechanism includes at least one hook,
at least one pole connected to said hook, and
a latching mechanism connected to said at least one pole and in communication with said member; and

wherein when said latching mechanism latches in a closed position, said hook can secure said platform to the patient carrying device.

8. The apparatus according to claim 6, wherein said securing mechanism includes a crossbar,
two hooks connected through said crossbar,
two poles extending from said crossbar, and
a latching mechanism at the end of each pole, said latching mechanisms are in communication with said member; and

wherein when said latching mechanism latches in a closed position, said hook can secure said platform to the patient carrying device.

9. The apparatus according to claim 6, wherein said securing mechanism includes at least one stabilizing mount, and
a latching mechanism attached to said stabilizing mount; and
wherein said footing includes a strike capable of engaging said latching mechanism.

10. The apparatus according to any of claims 1-9, wherein said accessory clip includes at least one tab having an opening passing therethrough, said tab sized to fit through at least one of the openings in said support surface,

said support surface including at least one tab extending from a bottom of said support surface, said tab having an opening passing therethrough, said tab approximate to one of the openings passing through said support surface,

said pin sized to fit through the opening in said tab of said accessory clip and the opening of said tab of said support surface.

11. The apparatus according to any of claims 1-11, wherein one of the openings passing through said support surface is at least one slot located approximate an edge of said support surface,

said accessory clip includes a connector having a tab, a bridge connected to said tab, and a tongue connected to said bridge, said tongue is shaped such to travel through the at least one slot of said support surface.

12. The apparatus according to claim 1, wherein said accessory clip attaches to at least one piece of medical equipment.

13. The apparatus according to any of claims 1-11, wherein said accessory clip includes means for attaching to at least one piece of medical equipment.

14. A system for attaching to a litter and carrying medical equipment needed for the care of a patient, said system comprising:

a platform including

a support surface having a plurality of openings passing therethrough and at least two walls depending from an opposing ends to each other,

a hinge attached to each wall, and

a leg attached to each hinge, said leg including two footings spaced from each other;

at least one accessory table including

an interface sized to communicate with at least one opening through said support surface, said interface having an opening passing therethrough, and

means for attaching to at least one piece of medical equipment; and

at least one pin, said pin sized to communicate with the opening of said interface and said support surface; and

wherein said interface is held in communication with said support surface by said at least one pin.

15. The system according to claim 14, wherein each of said legs includes

a support piece having at least one opening passing therethrough and attached to said footings,

a securing mechanism,

a pair of slide pieces each of which is connected to said support piece and said securing mechanism, and

each of said legs having at least two pairs of openings passing therethrough and two slots running parallel to each other and between the members of the opening pairs, each of said slide pieces is in communication with a respective slot, said at least one pin is sized to fit through one of the openings in said leg and the opening in said support piece, and the opening in said support piece is in communication with at least one opening passing through said leg.

16. The apparatus according to any of claims 15, wherein said securing mechanism includes

at least one hook,

at least one pole connected to said hook, and

a latching mechanism connected to said at least one pole and in communication with said member; and

wherein when said latching mechanism latches in a closed position, said hook can secure said platform to the patient carrying device.

17. The apparatus according to claim 15, wherein said securing mechanism includes a crossbar,

two hooks connected through said crossbar,

two poles extending from said crossbar, and

a latching mechanism at the end of each pole, said latching mechanisms are in communication with said member; and

wherein when said latching mechanism latches in a closed position, said hook can secure said platform to the patient carrying device.

18. The apparatus according to claim 15, wherein said securing mechanism includes at least one stabilizing mount, and

a latching mechanism attached to said stabilizing mount; and

wherein said footing includes a strike capable of engaging said latching mechanism.

19. A method for using the system according to claim 14 that further comprises a securing mechanism in communication with each leg, said method comprising:

selecting the medical equipment that will or may be needed to care and/or transport a patient on a litter,

selecting the accessory clips that will enable attachment of the selected medical equipment,

attaching the selected medical equipment to the selected accessory clips,

inserting the tabs and/or tongues of the selected accessory clips into the support surface and inserting a pin into each pair of tab openings that are in communication with each other, and

attaching the platform to a litter by placing the footings on the poles of the litter, placing a portion of the securing mechanism below the litter poles, and locking the securing mechanism in place for use.

20. A system for carrying medical equipment on a patient carrying device without interfering with the space for the patient, said system comprising:

at least one means for attaching to at least one piece of medical equipment,

means for supporting and positioning said attaching means to the side and/or above the patient on the patient carrying device, said supporting and positioning means including means for adjusting the height of the supporting and positioning means relative to the litter.

21. The system according to claim 20, further comprising means for securing said system to the litter.

22. A device for attaching and carrying medical equipment as herein described with reference to the accompanying drawings.

23. An accessory clip as herein described with reference to the accompanying drawings.

24. An accessory clip comprising:

a monitor pan,

a disc attached to said monitor pan,

a bearing,

a base having two tabs each with an opening passing therethrough,

a second bearing, and

a hub connected to said disc through a bolt, said bolt in communication with said bearing, said base, and said second bearing.

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FIG. 1

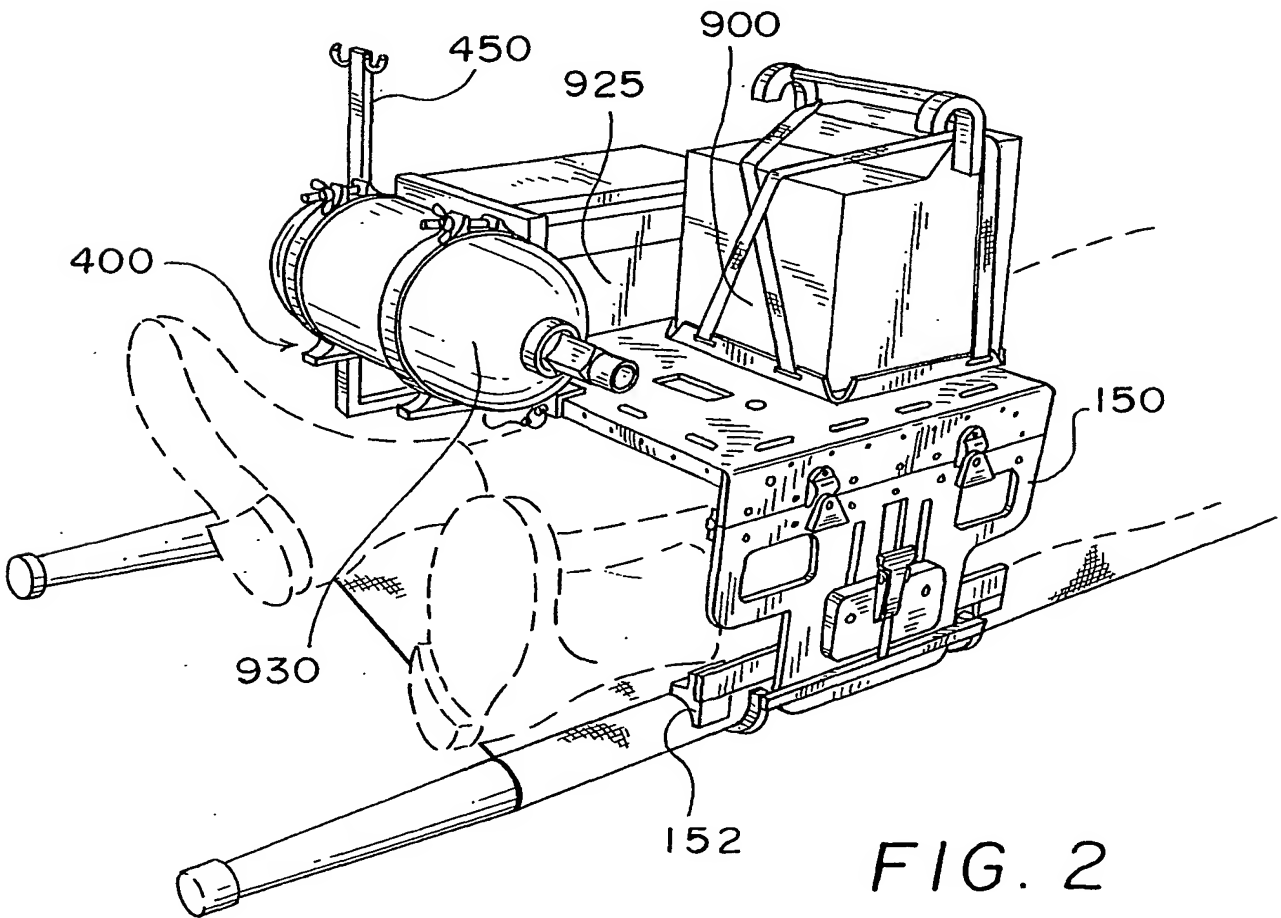
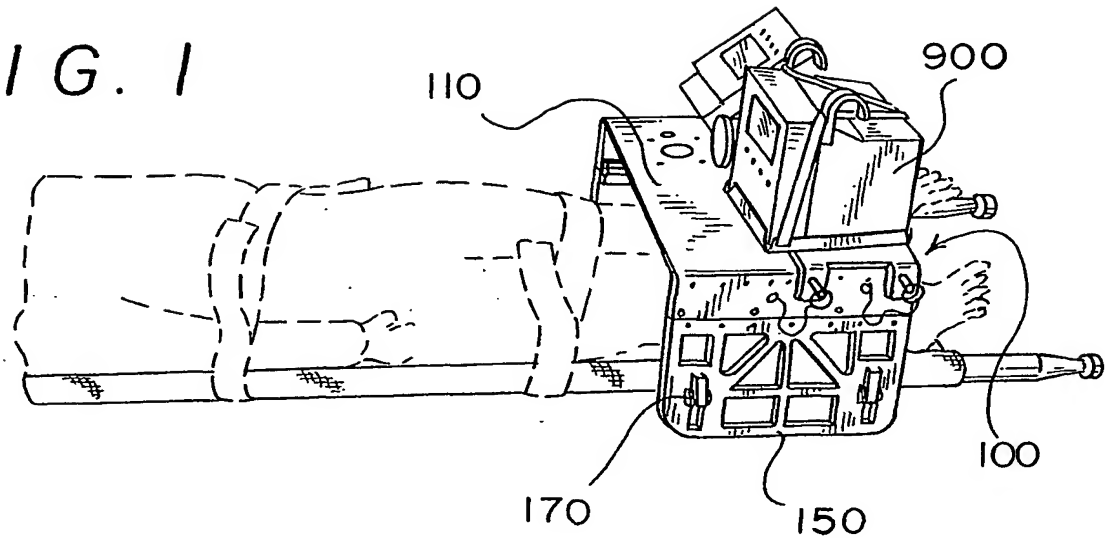
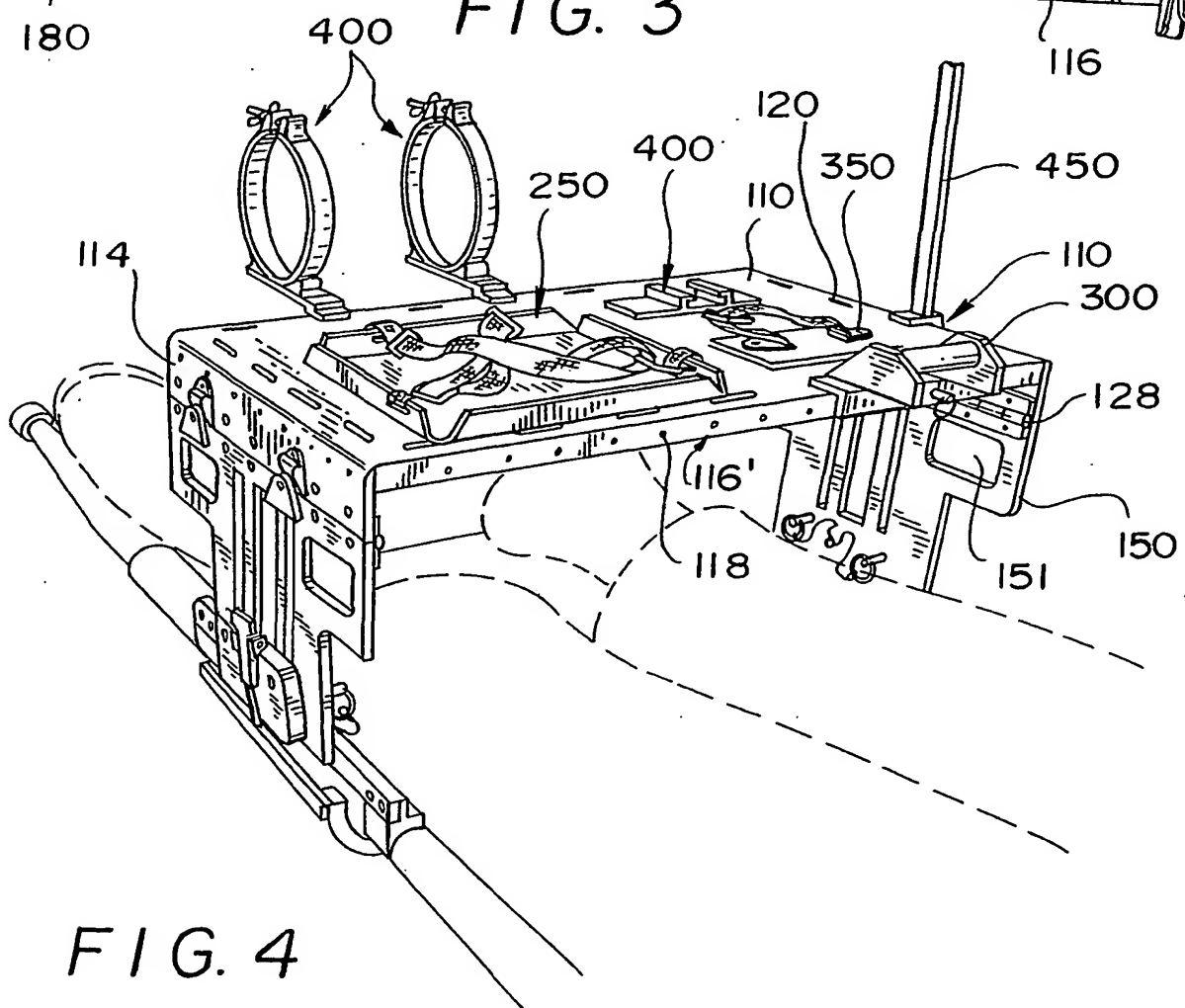
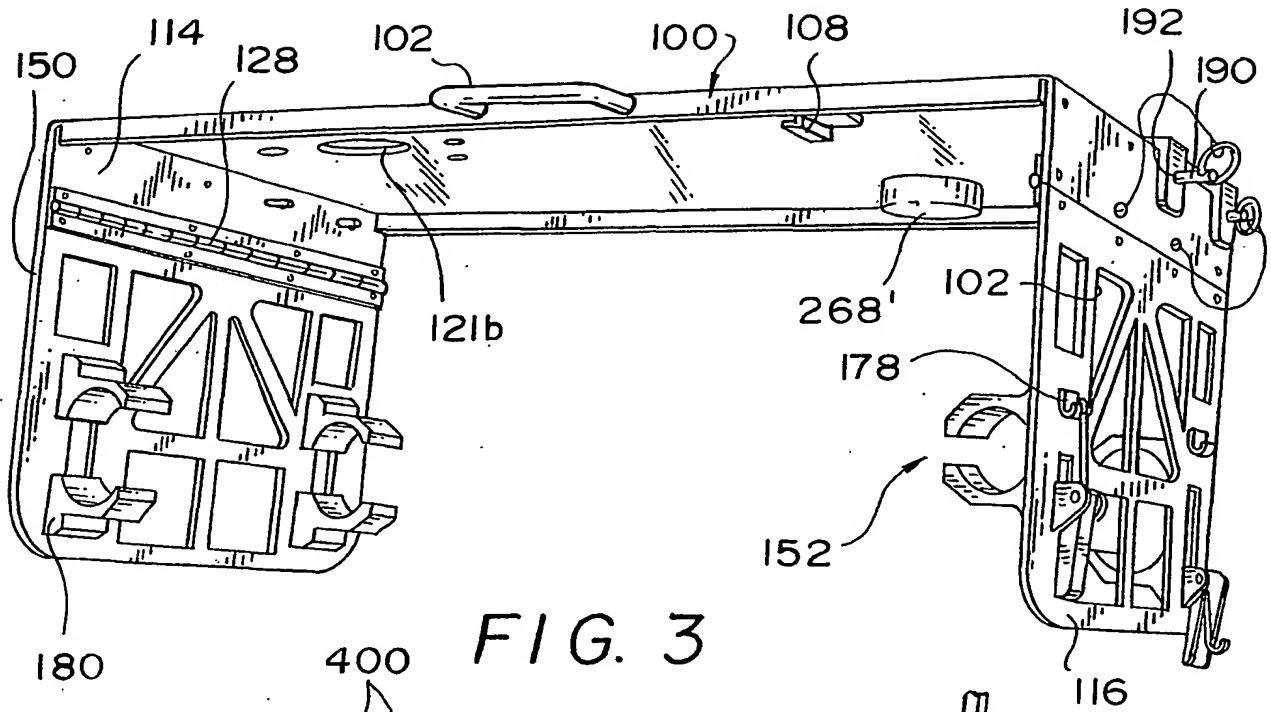


FIG. 2

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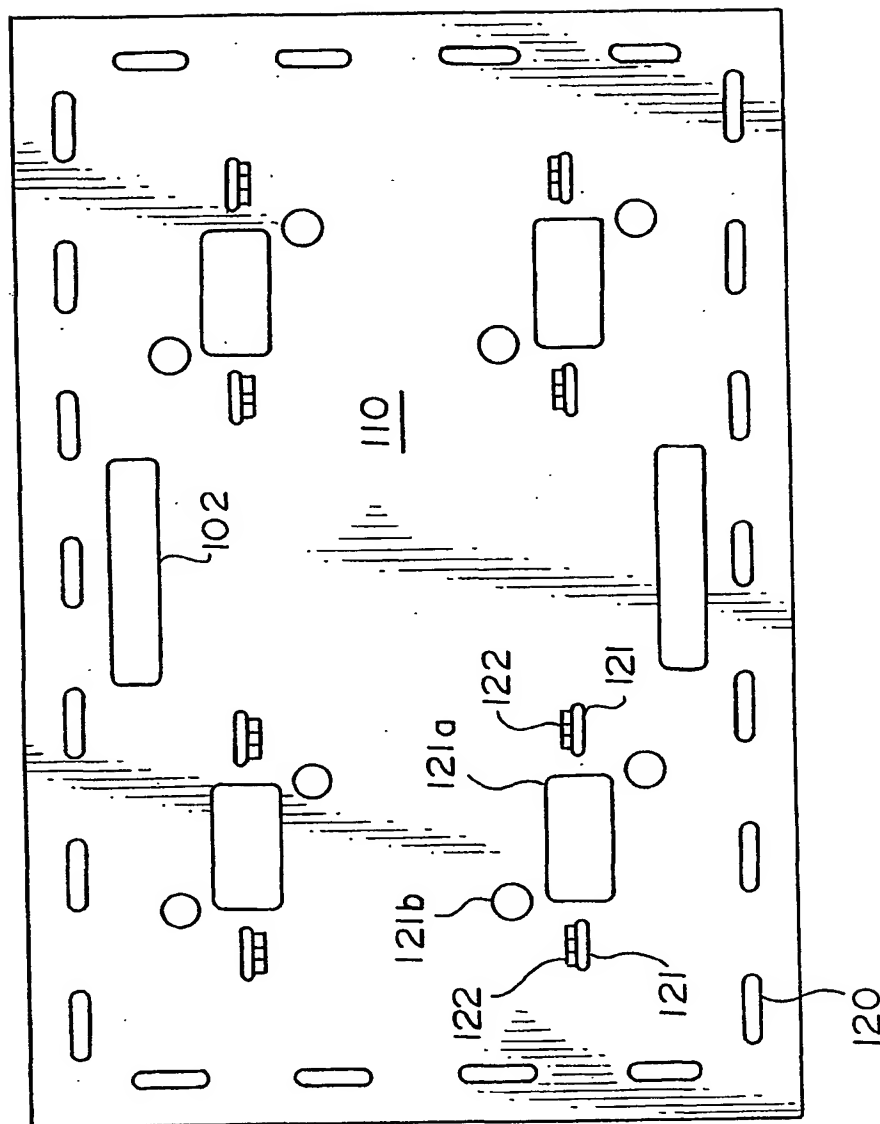


FIG. 5

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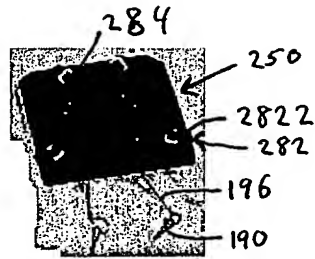


Figure 6(a)

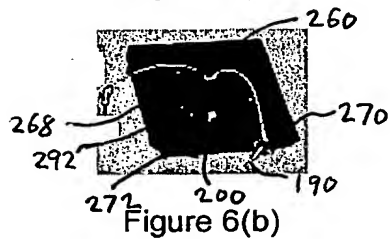


Figure 6(b)

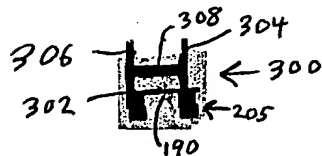


Figure 7(a)

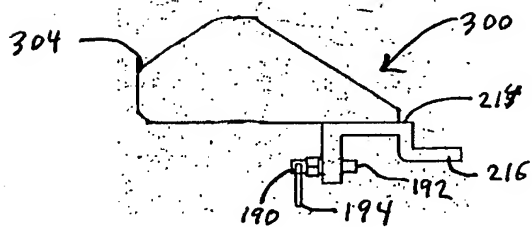


Figure 7(b)

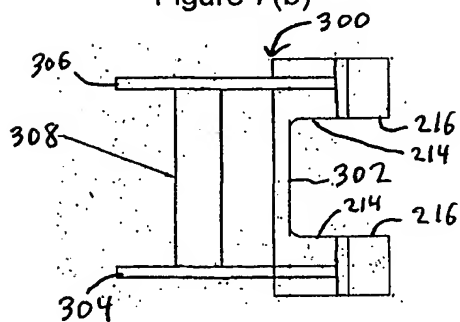


Figure 7(c)

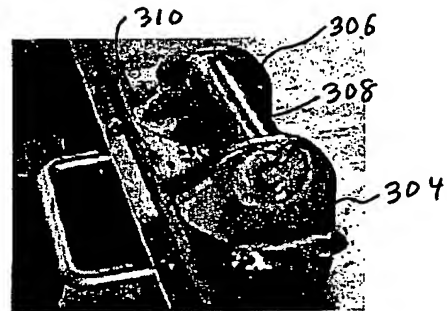


Figure 7(d)

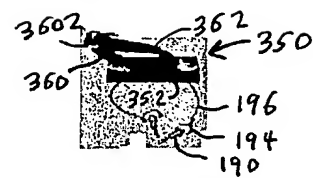


Figure 8(a)

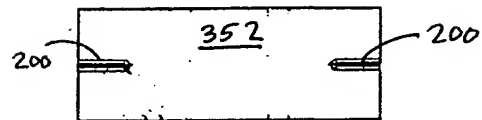


Figure 8(b)

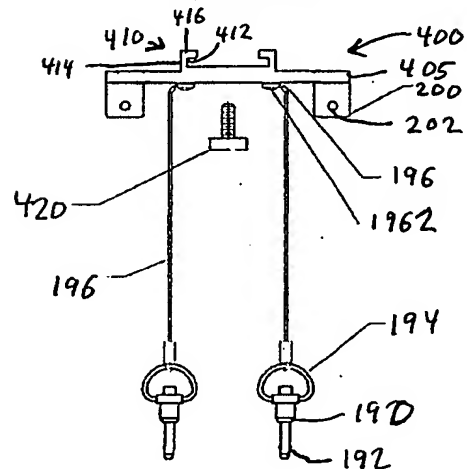


Figure 9(a)



Figure 9(b)

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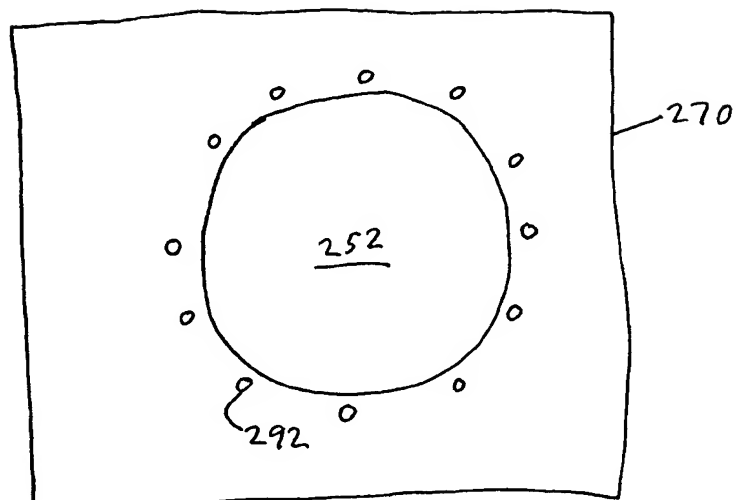


Figure 6(c)

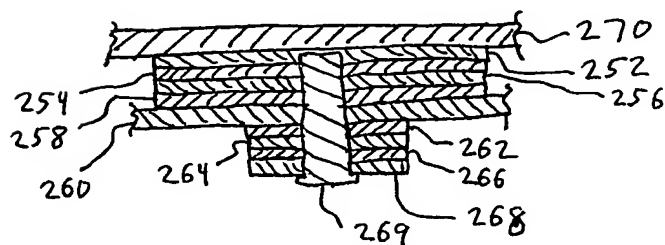


Figure 6(d)

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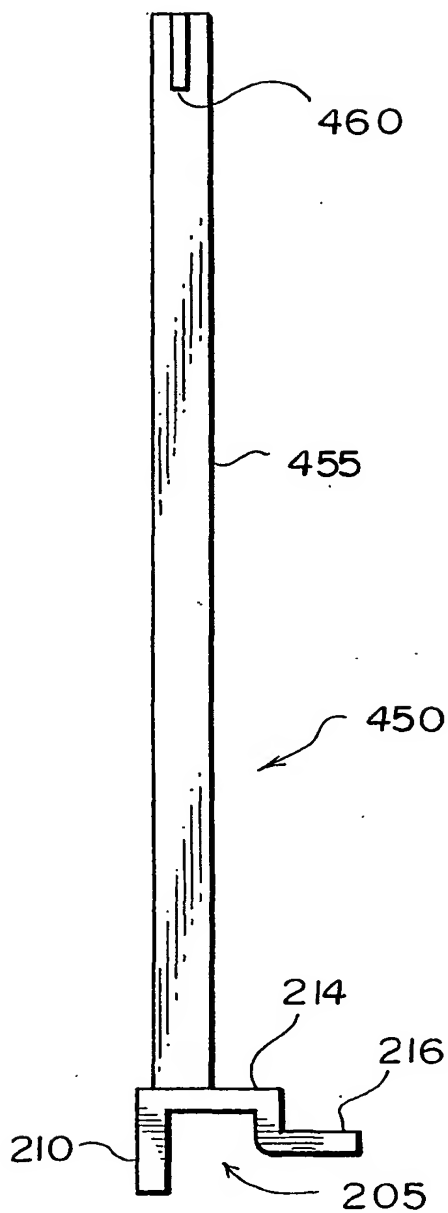


FIG. 10(a)

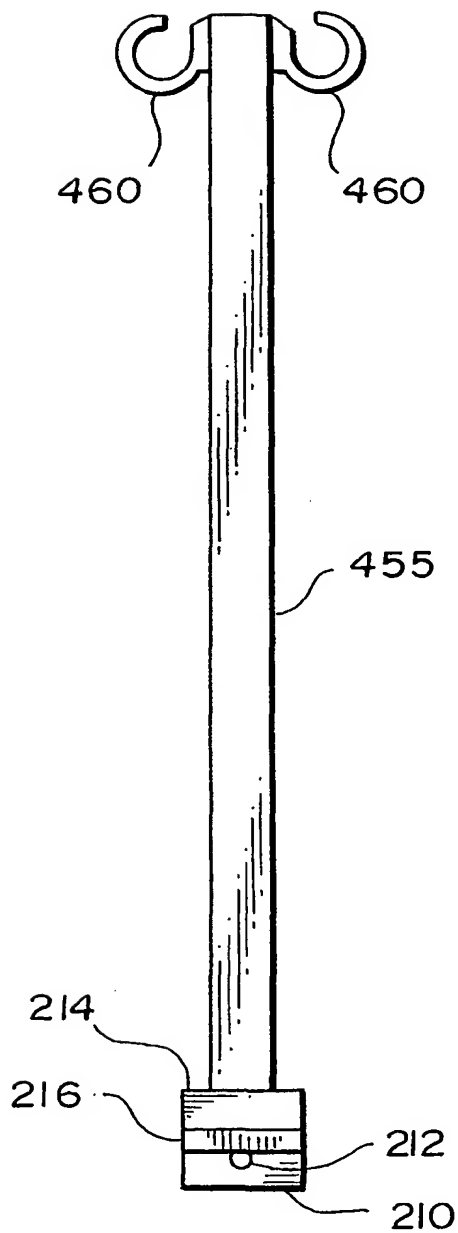


FIG. 10(b)

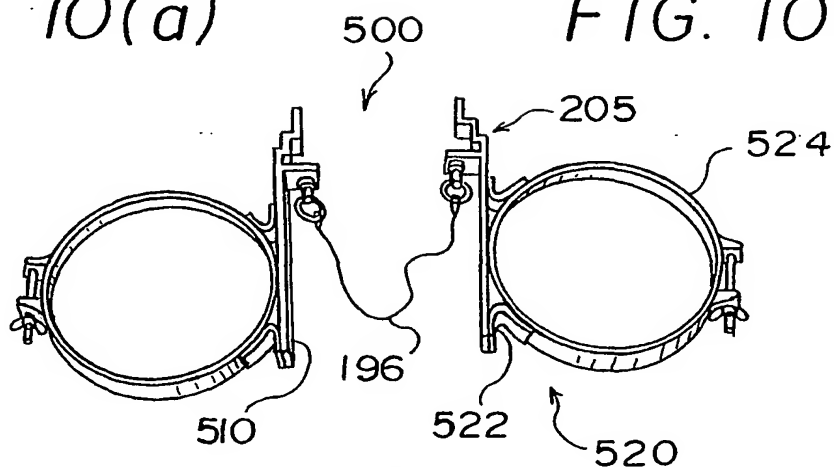


FIG. 11

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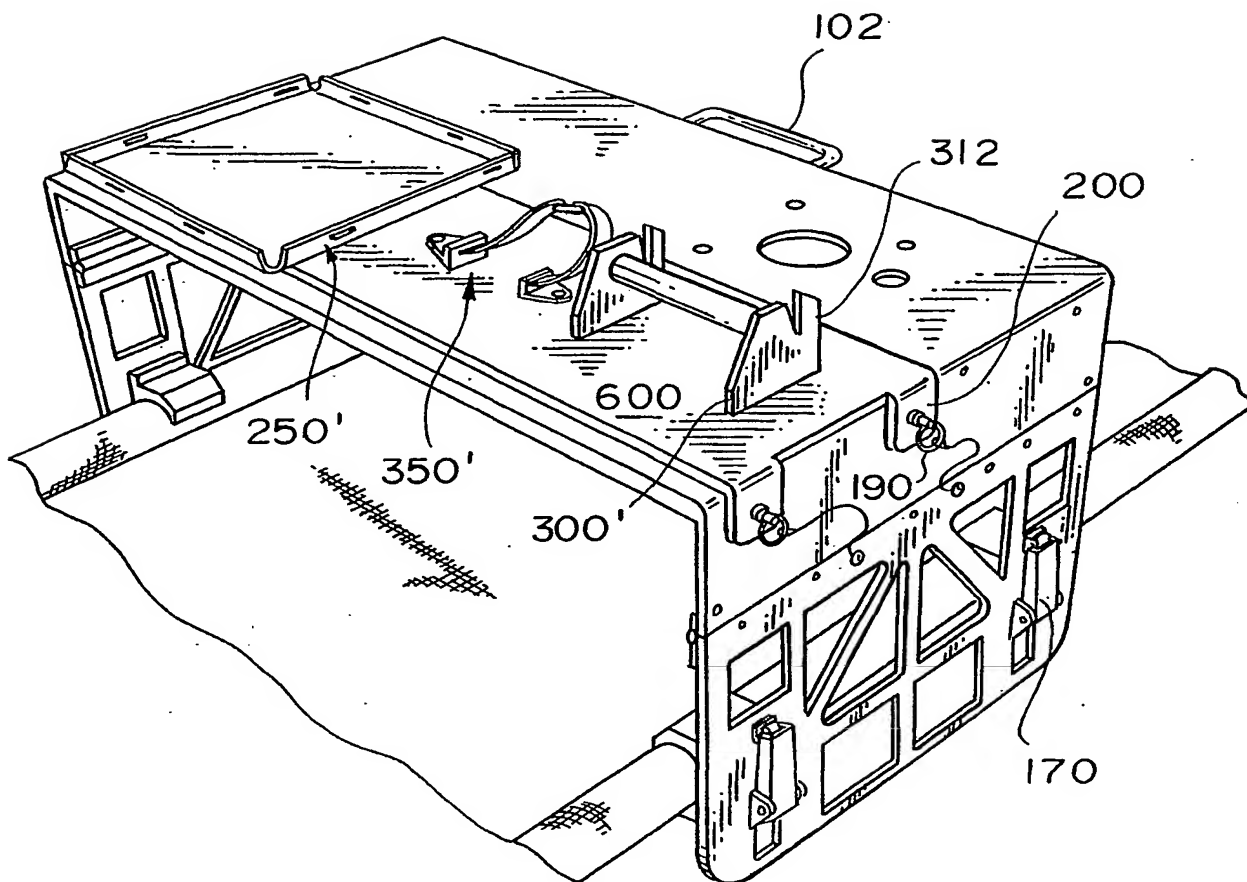


FIG. 12(a)

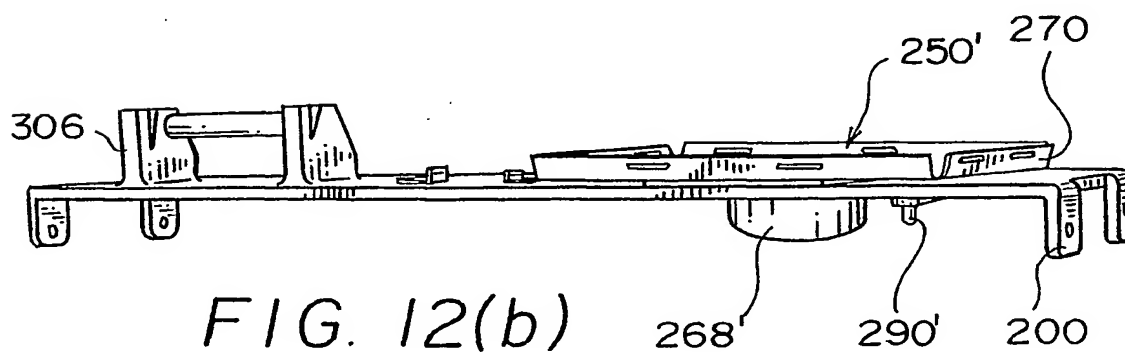


FIG. 12(b)

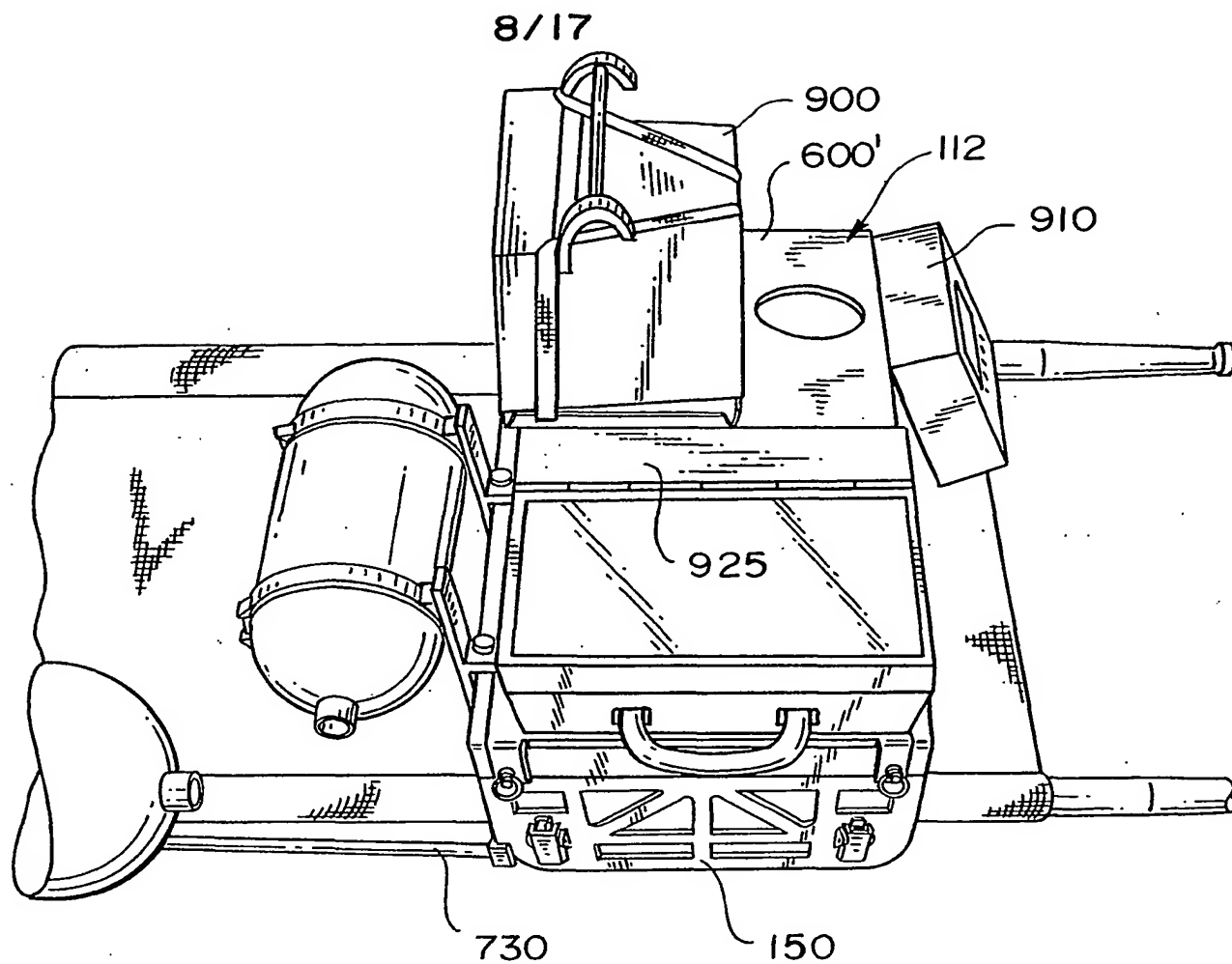


FIG. 13

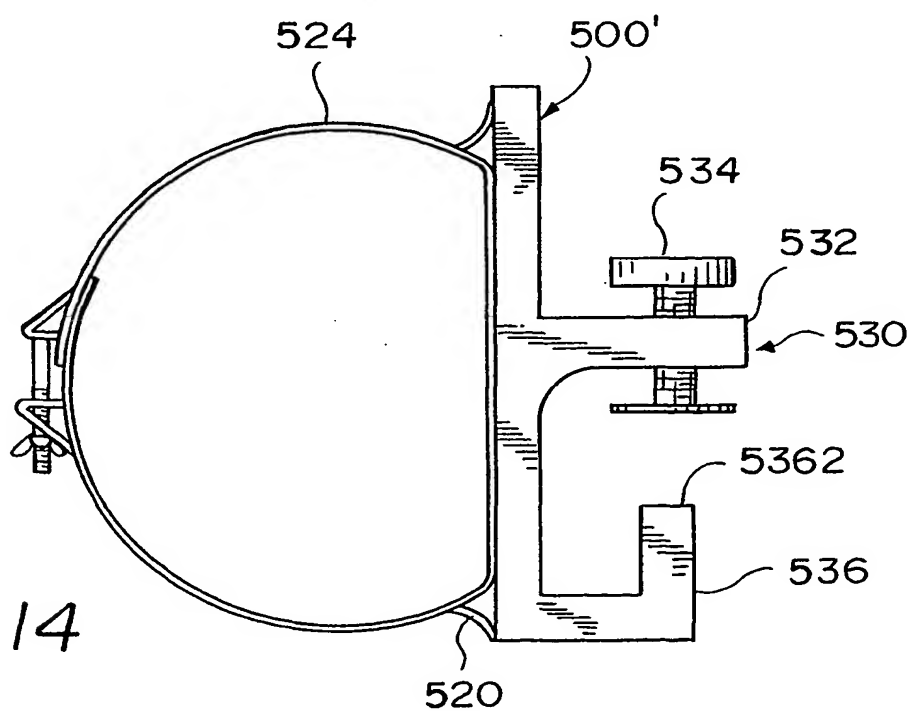


FIG. 14

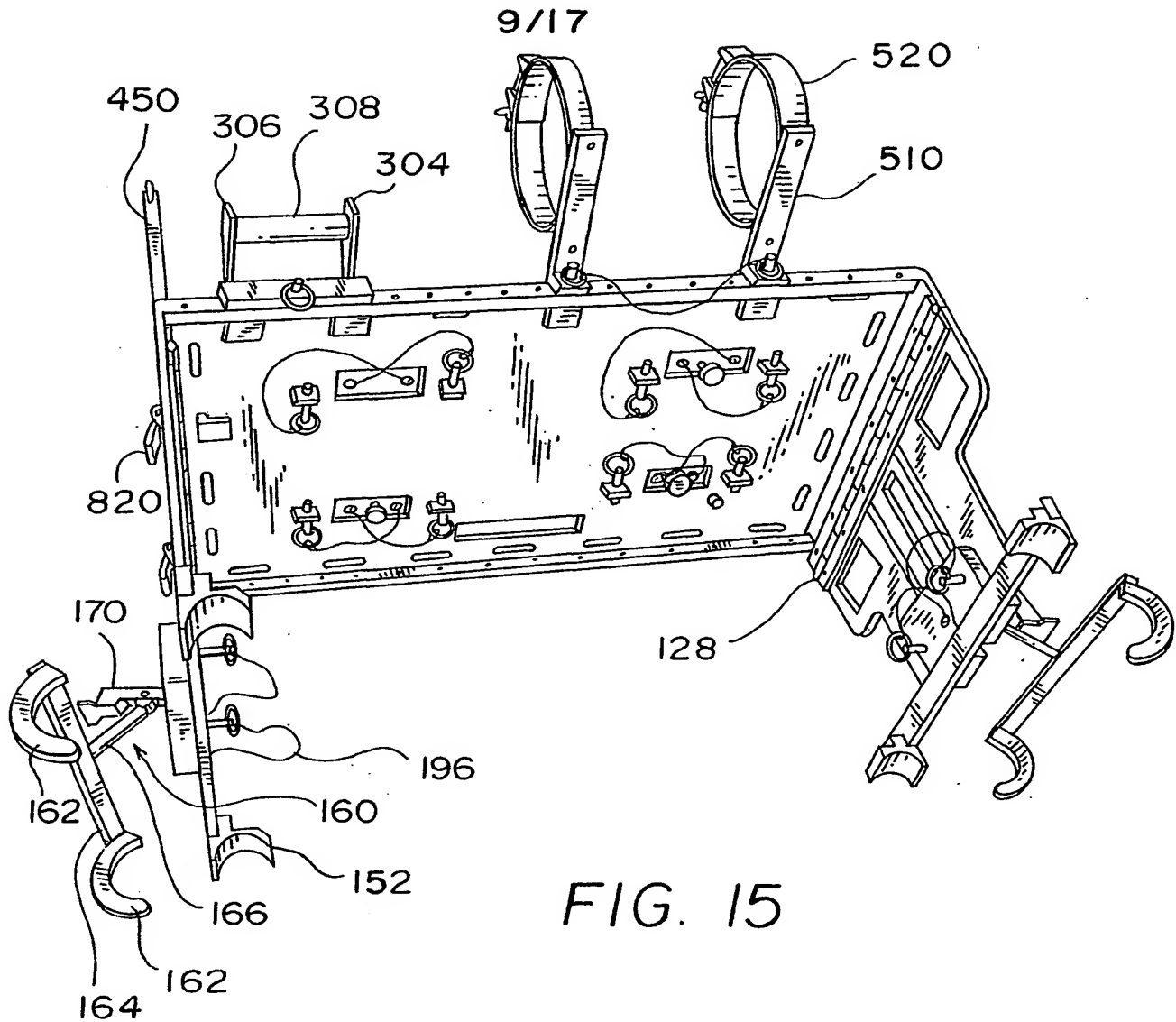


FIG. 15

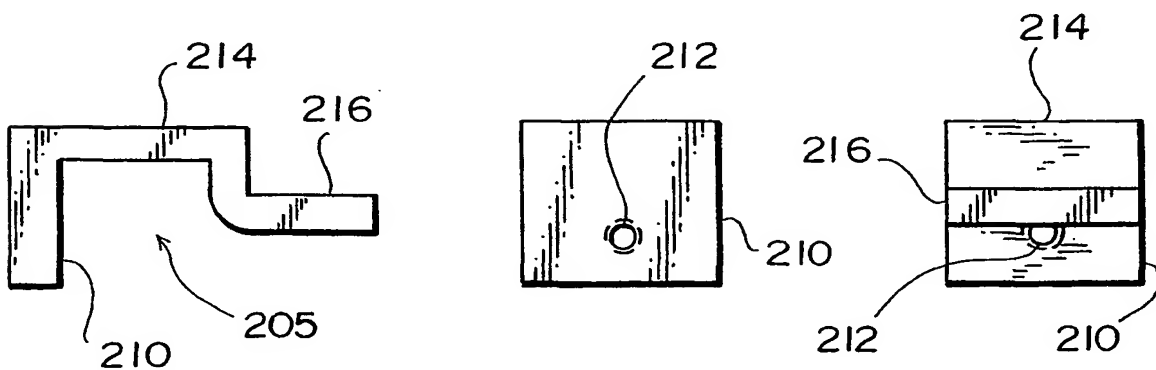


FIG. 16(a)

FIG. 16(b)

FIG. 16(c)

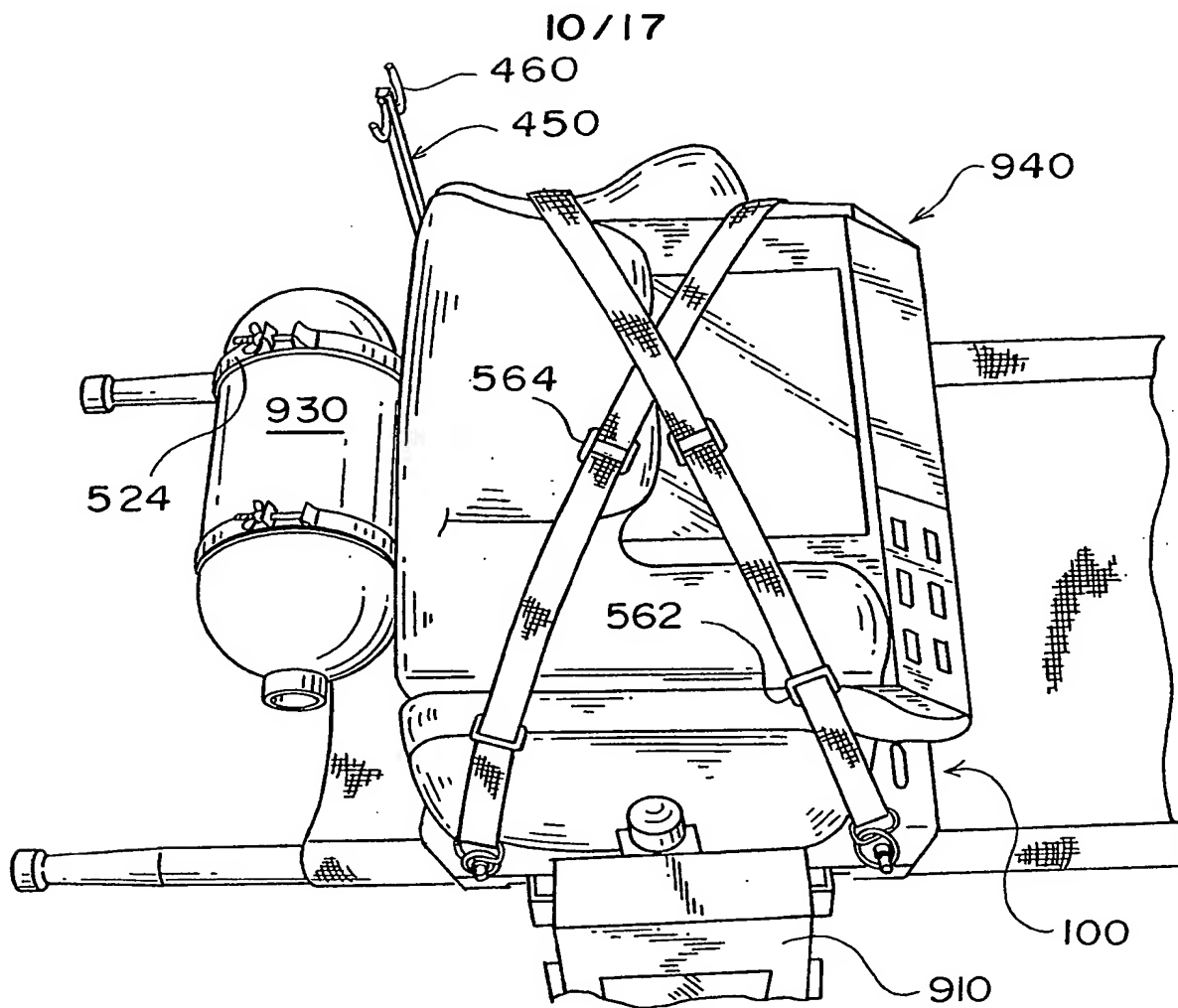


FIG. 17(a)

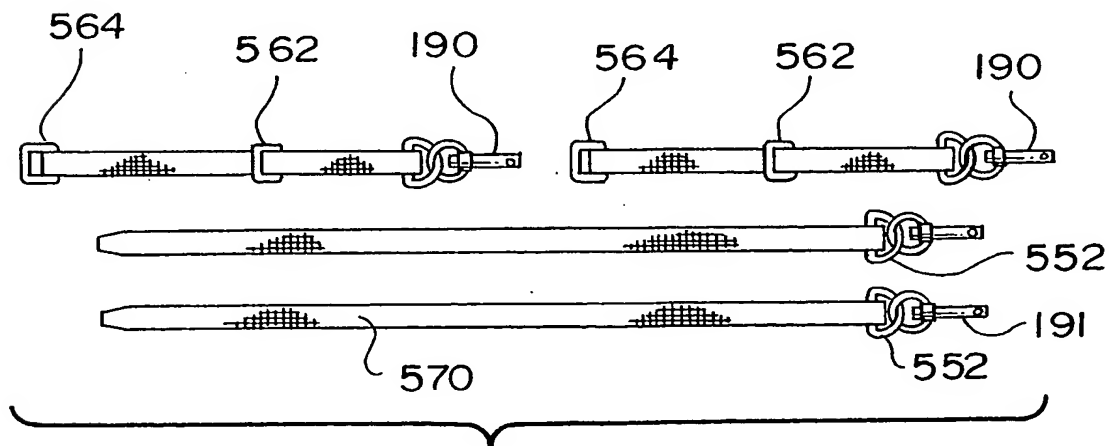


FIG. 17(b)

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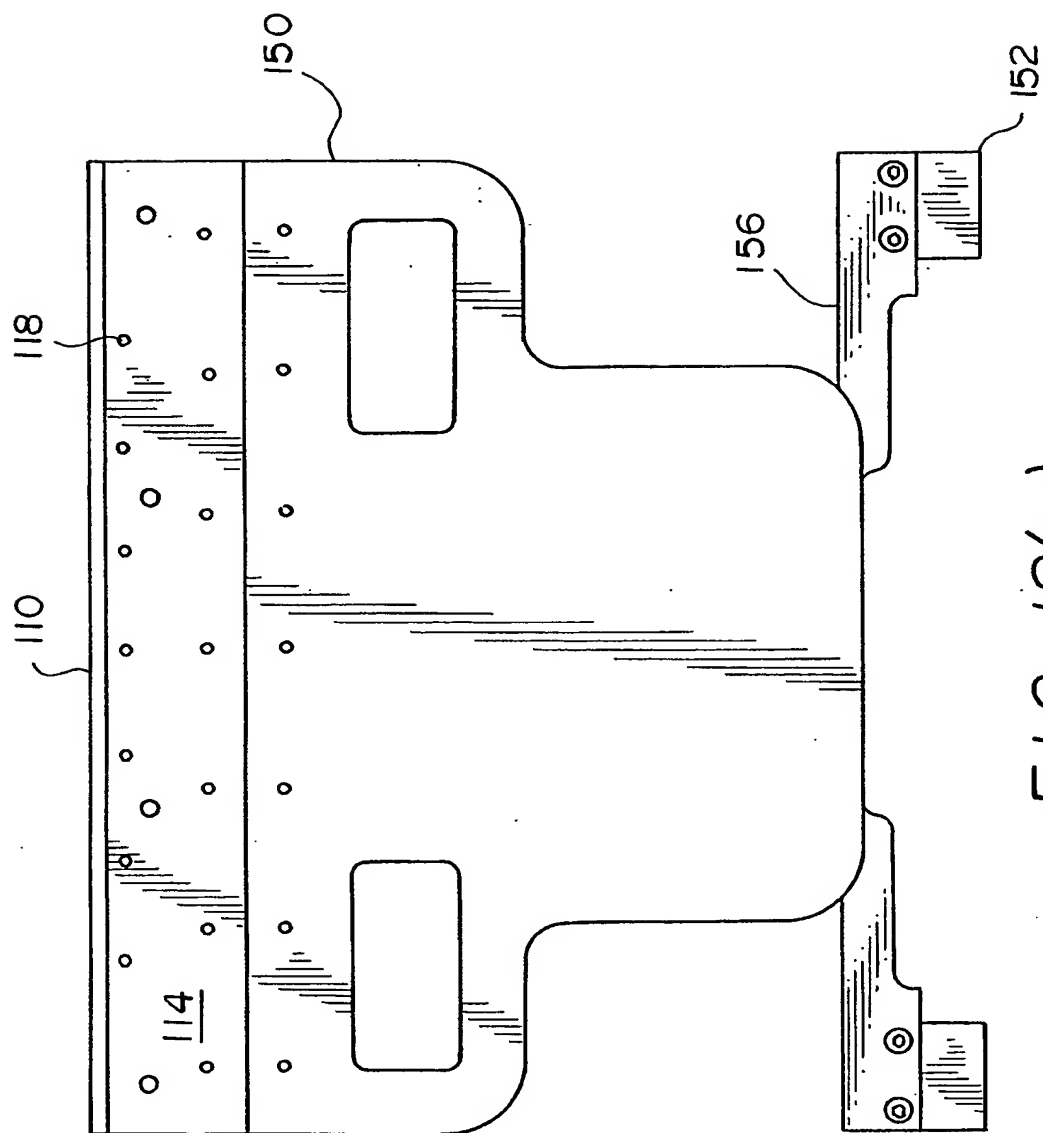


FIG. 18(a)

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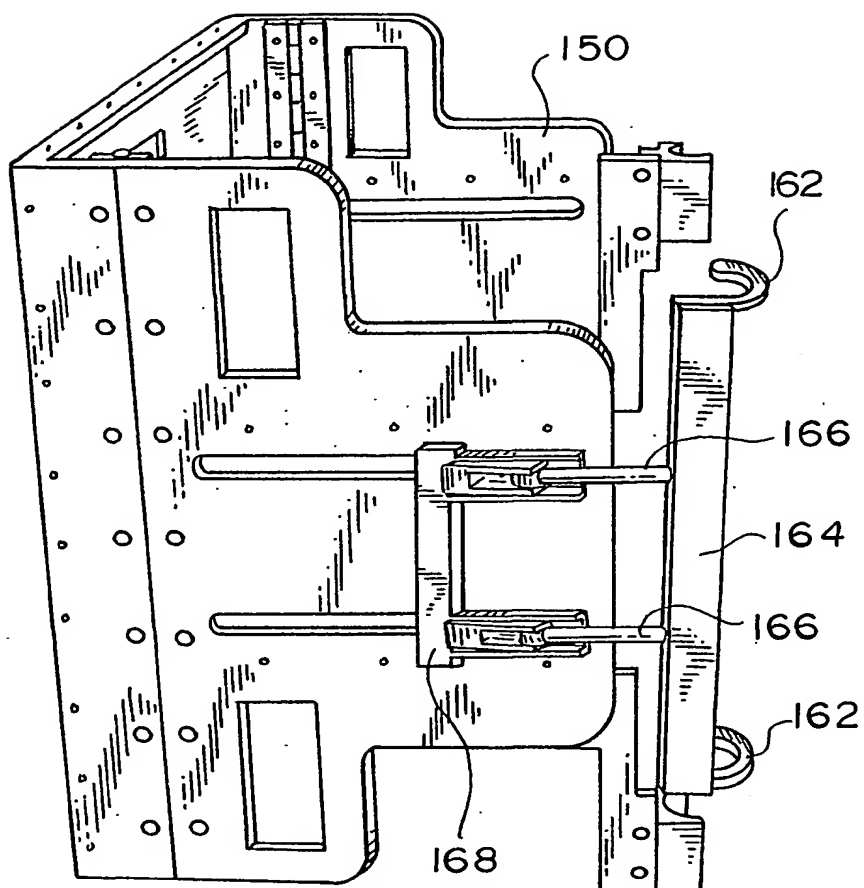


FIG. 18(b)

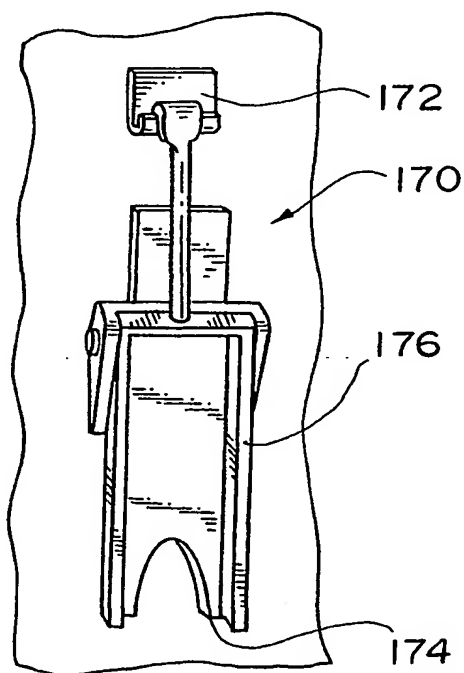


FIG. 19

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FIG. 20(a)

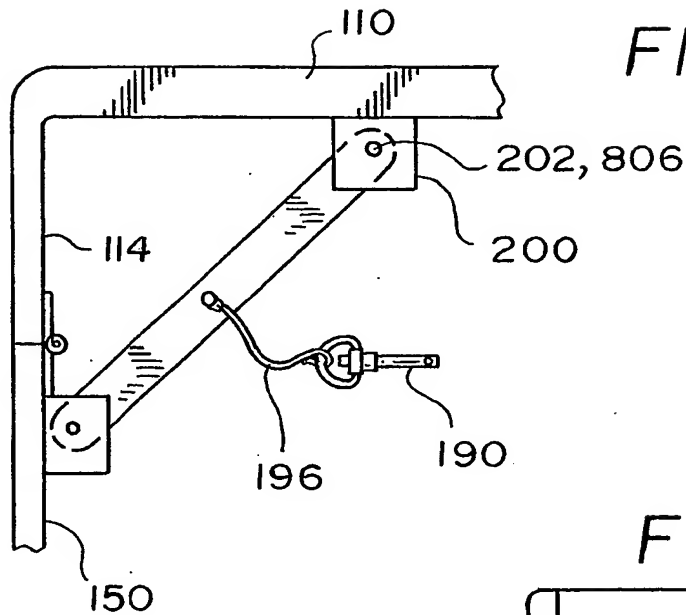


FIG. 20(b)

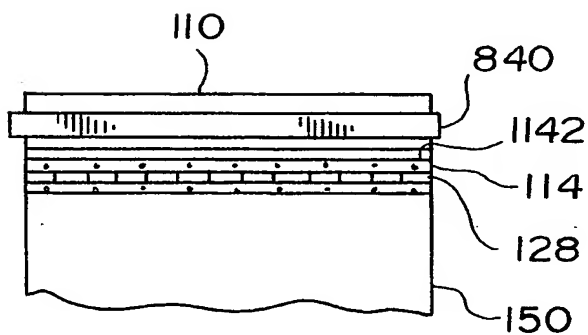
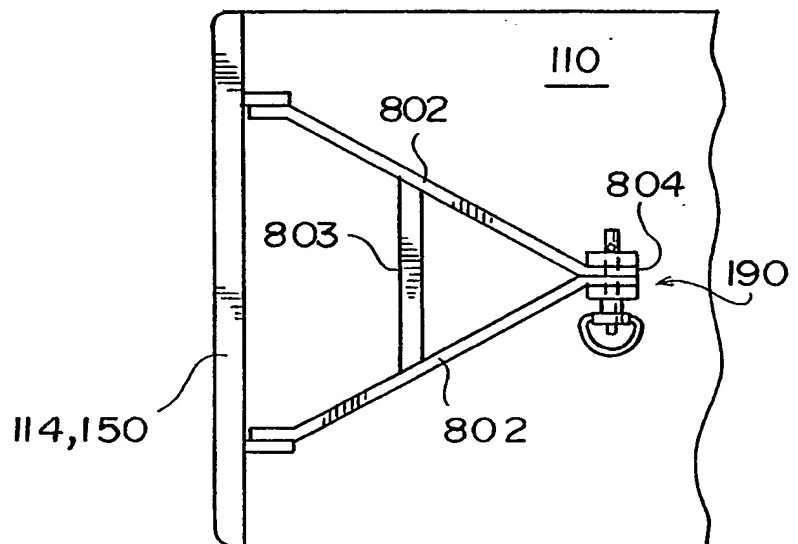


FIG. 21(a)

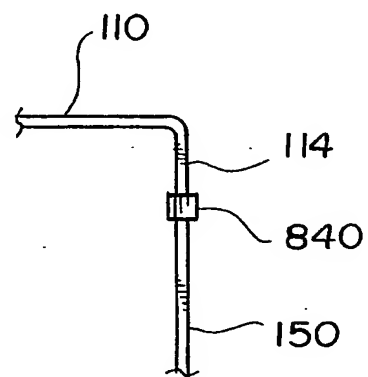
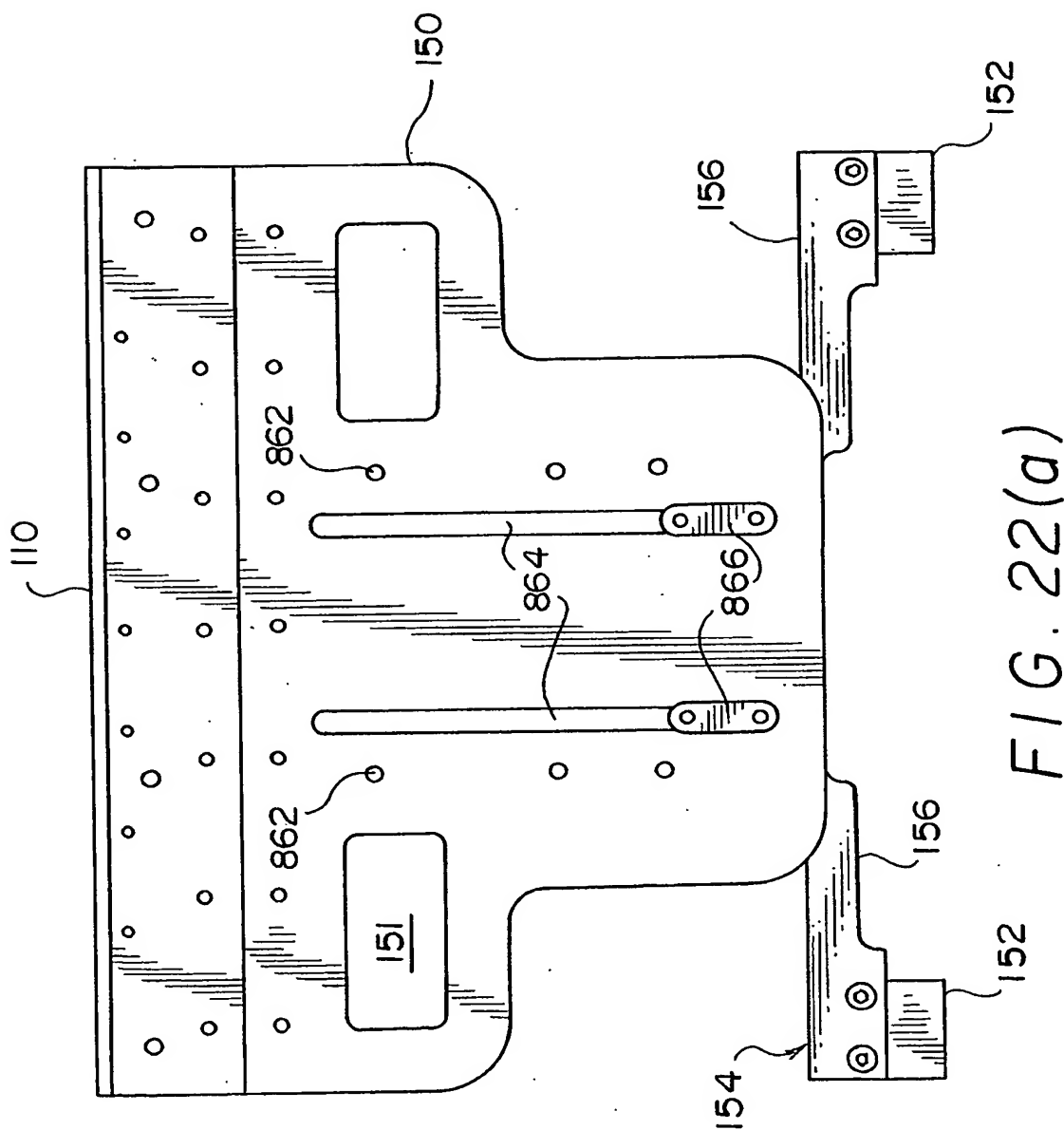


FIG. 21(b)

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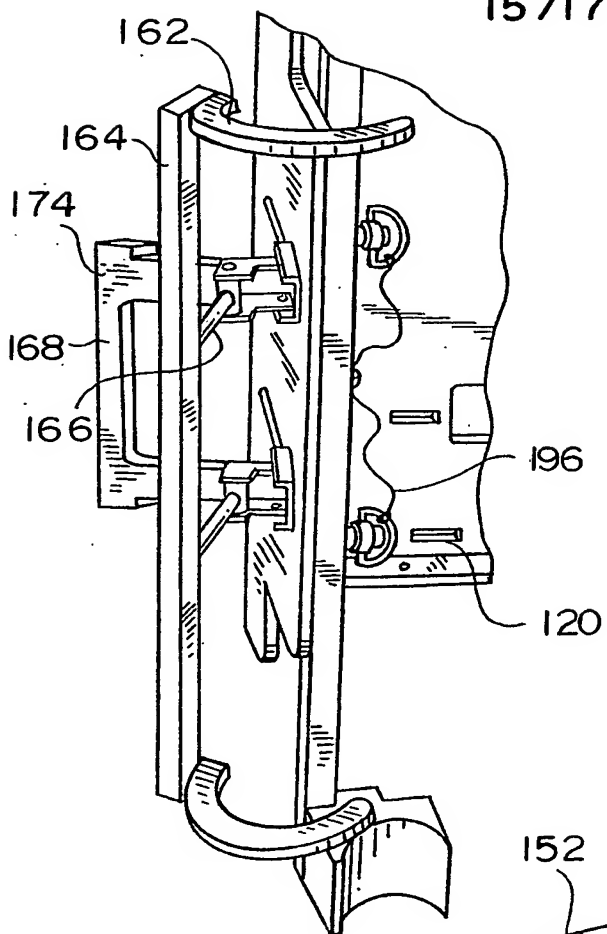


FIG. 22(b)

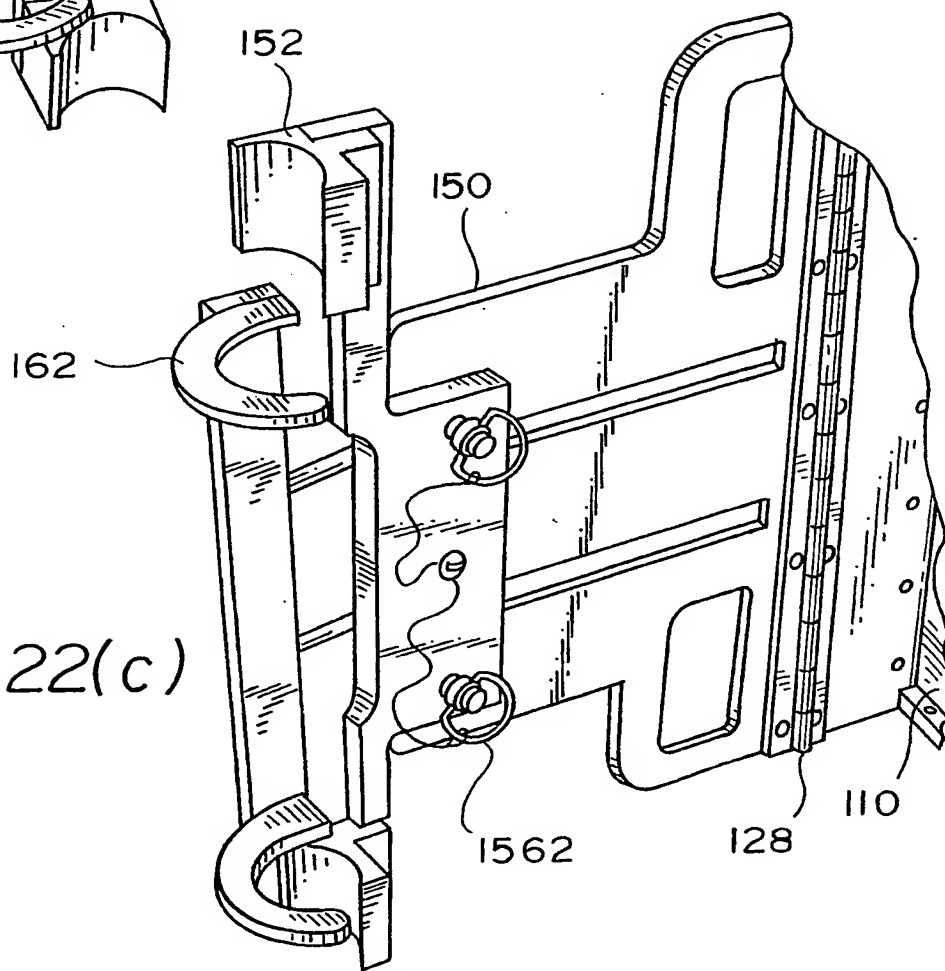


FIG. 22(c)

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FIG. 23(a)

FIG. 23(b)

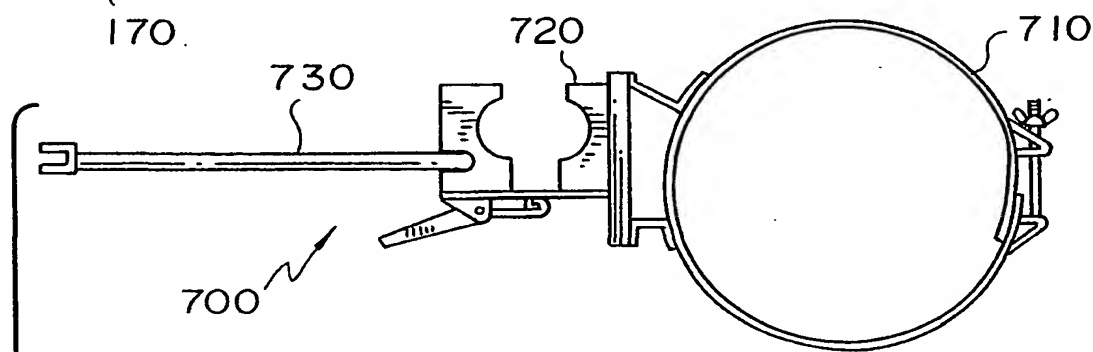
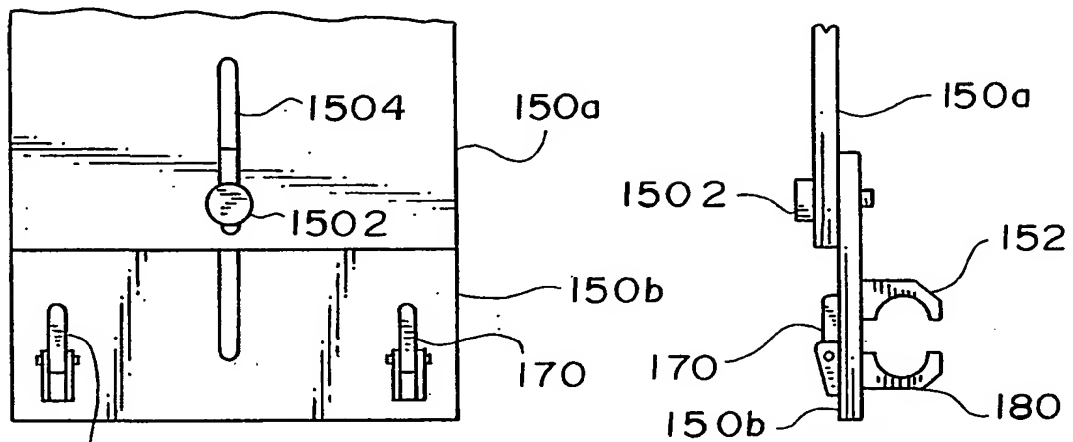


FIG. 24(a)

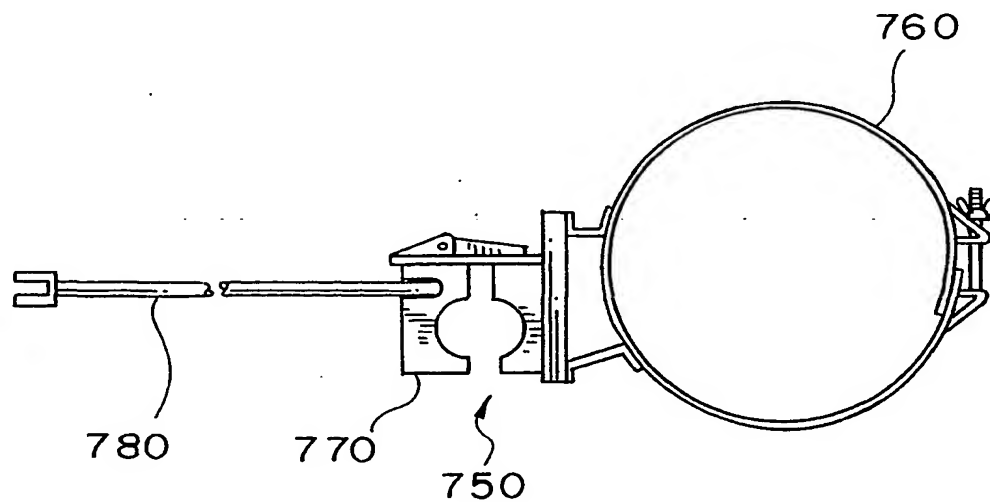


FIG. 24(b)

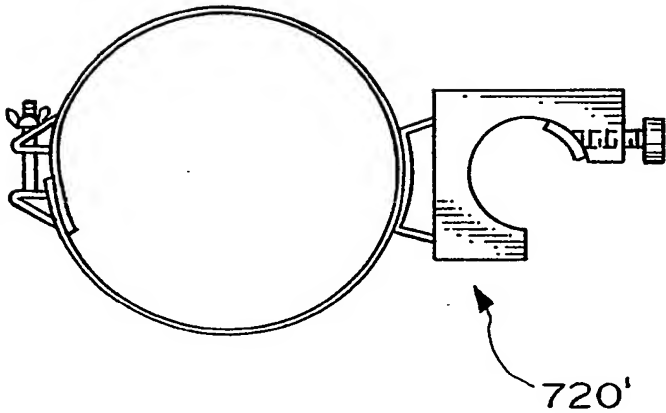
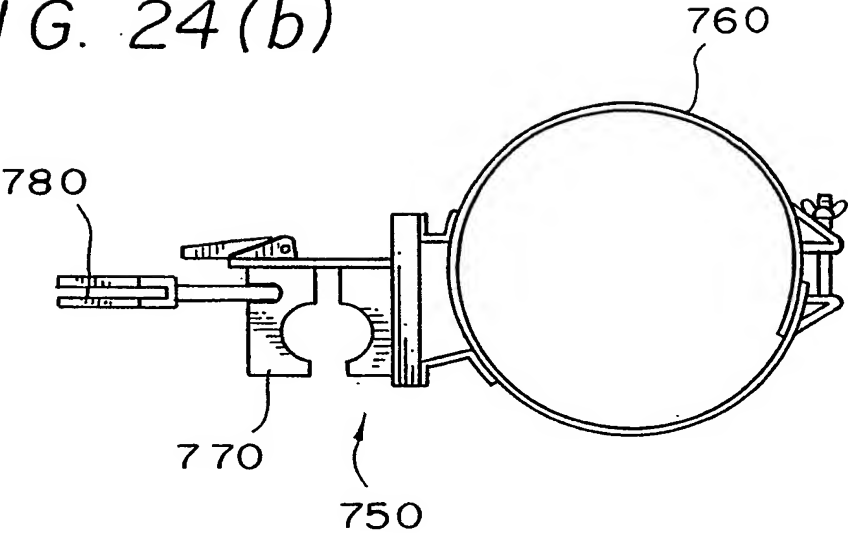


FIG. 24(c)

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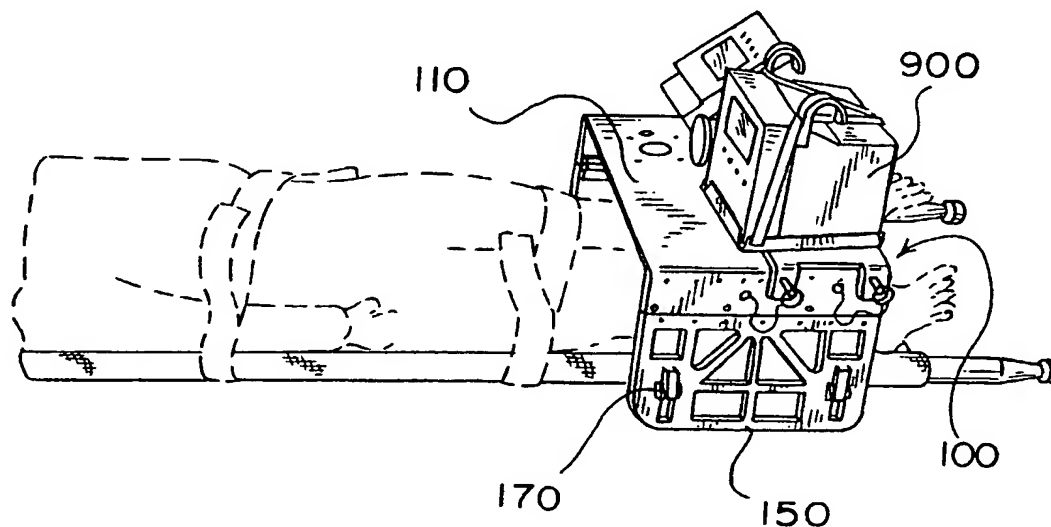
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(54) Title: CRITICAL CARE PLATFORM FOR LITTERS



(57) Abstract: This invention preferably includes a platform (100) having a support surface (110), a pair of legs (150, 150) connected to the support surface (110), and footings (152) and securing mechanism (160 or 180) on the legs (150, 150) for attaching the invention to a litter that preferably satisfies NATO requirements. Preferably, the invention attaches to the poles used to carry a patient on a litter such that the invention provides space for the patient's legs to pass under if necessary. A further embodiment of the invention adds at least one accessory clip, which preferably includes at least one attachment for a piece of medical equipment such as medical monitors, ventilators, and infusion pumps.



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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,557,453 A (McCloskey) 10 December 1985 (10.12.1985), cols. 2 and 3.	20-22
A	US 4,783,109 A (Bucalo) 08 November 1988 (08.11.1988), Figs. 3 to 8.	1, 14, 20
A, P	US 6,175,977 B1 (Schumacher et al) 23 January 2001 (23.01.2001), Figs. 8 to 11.	1, 14, 20
A	US 4,691,397 A (Netzer) 08 September 1987 (08.09.1987), Fig. 1.	1, 14, 20
A	US 4,747,172 A (Hohol et al) 31 May 1988 (31.05.1988), Fig. 4.	1, 14, 20
A	US 5,152,486 A (Kabanek et al) 06 October 1992 (06.10.1992), Figs. 1-4.	1, 14, 20

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